THE IRON TRADE REVIEW

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THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The week has been full of reports of important deals among the large interests, none of them confirmed, and none having a bearing on the immediate future of the iron market, though given more or less significance in stock exchange circles. Mr. Carnegie has denied that any proposition for the purchase of control in his company has been made to him, and there are more or less circumstantial denials of the report that Federal Steel Co. interests are acquiring or are to acquire control of the American Steel & Wire Co. The important event of the week from a market standpoint was the purchase of 100,000 tons of Bessemer iron by the leading Pittsburg interest, for delivery in the next five months. The price is understood to have been $12.50 at Valley furnace, or $13.75 at Pittsburg under the new freight effective Feb. 1—the lowest price for Bessemer iron from merchant furnaces since the early stages of the boom of 1899, and one that with some of the valley furnaces discounts the reduction under new coke contracts, and the new basis for ore and labor. It is understood that the 100,000-ton purchase is in addition to metal which the leading producer will take in exchange for coke, deals of the latter description probably amounting to 50,000 tons more. Pending the blowing in of their new furnaces it is probable that other steel interests will enter the market for Bessemer iron for delivery in the first half, but there is no great outlook for profit to the furnacemen, as the business already placed will occupy less than one-fourth the capacity of merchant furnaces available for Bessemer iron, in the next six months. If the labor situation is settled it is probable several valley furnaces will resume about Feb. 1. There is nothing in the present outlook for foundry iron to call any furnaces heretofore on Bessemer into the foundry field. Second in interest to the transaction noted above the event of the week is the concluding of a deal between the Sharon Tin Plate Co.—an allied interest of the Sharon Steel Co.—and the American Tin Plate Co., by which the latter will take all the output of the 20-mill plant now nearing completion at Sharon. This removes from the market the tin plate consolidation's most formidable competitor. It is probable that an arrangement is also made by which the new steel plant will sell no sheet bars in the market. The indications in the rail trade are more favorable to an advance in the price than at any time since the reports of such an intention were started. The manufacturers of rails and of billets met in New York last week, but took no action on prices. The fact that quotations have been made recently subject to change without notice is taken to point to an advance, the general belief being that the price will be $28 for standard sections after Feb. 1. There is relatively little important new business in finished material. Large buyers will not need to enter the market for some time and meantime most mills are quite full of work, though there are indications that some of the bar mills are going after business a little more vigorously, and some of the plate mills are now able to make deliveries within a few weeks, though the larger plate producers are filled up for months. The promise for structural work the coming season is excellent in every direction. Wire and wire nail mills are having just the reverse of their experience one year ago, being now full of orders and each week making large additions to the volume. The situation in the foundry trade has not fully developed as yet and buying of foundry iron is light. A contract of 8,000 tons in the Chicago district was an exception to the rule. Pipe foundries, after a period of light demand, are increasing their operations materially and are good buyers of iron. Southern furnaces as a rule are adhering to $11 for No. 2 foundry iron at Alabama furnace; from Tennessee furnaces this price is cut 25 to 50 cents. Northern furnacemen are expecting a reduction in coke freights and the rate on ore from Lake Erie docks is also likely to be lowered.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
429 PARK BUILDING, Jan. 23.

The purchase of 100,000 tons of Bessemer iron by the Carnegie Steel Co. this week, for delivery within the next five months, is one of the largest transactions in Bessemer within a period of more than a year. It will do much toward clearing up the Bessemer pig iron situation, which for the past six months has been the enigma of the iron and steel trade. This large purchase of pig iron was made necessary at this time owing to the inability of the company to place in operation the new Carrie furnaces at the first of the year when it was expected they would be ready. In addition the company's steel producing capacity is still greater than its furnace capacity. We have been advised that the price paid for this iron was $12.50 at Valley furnace which would be equivalent to $13.25 delivered Pittsburg after Feb. 1, when the reduction in freight rates becomes effective. The sales in January previous to this one amounted to about 50,000 tons, and were nearly large enough to clean up the stock piles in the valleys both at the merchant and consolidation furnaces. This order will doubtless cause an early resumption at some of the idle merchant furnaces in the valleys and when the low price at which the business was taken is known there should be no doubt about the blast furnace workmen accepting the reduction in wages announced to take effect on Feb. 1, inasmuch as the operators have explained to them that when better prices are received for iron, wages will gradually be restored. A meeting of the merchant furnacemen will be held in Cleveland this week for the purpose of fixing a price on Bessemer iron for delivery in the first half of the year. The prevailing sentiment is in favor of fixing the price at $13 at the furnace or $13.75, delivered Pittsburg, after the first of next month. The meeting of the steel rail manufacturers held in New York last week resulted in no advance, although reports emanated from some quarters that an advance of $2 per ton might be made. Meetings of the manufacturers will again be held within the next week or ten days, and while there is considerable talk about advances to be made in both billets and rails there is some difference of opinion on the question whether conditions warrant them. In the case of steel rails it is argued that after the large purchasers have placed their orders a slight advance should be made to the small purchasers, and it is predicted that the price will be $28 after Feb. 1. There have been reports of lower prices on steel bars, but the largest producers in-

sist that 1.25c is the minimum with them. In plates little new business is being placed while structural steel is in fair demand. Extensive building projects have already been mapped out for the spring and summer, and there is every indication that there will be a big demand for structural material for building purposes this year. It is probable that lower rates from the Connellsville coke regions to the furnaces in Pittsburg and the two valleys will shortly be made by the railroads. A reduction of 10 per cent is under consideration.

PIG IRON.—After a wait of many months the Bessemer pig iron market is showing signs of life, though prices are the lowest since the early part of 1899. The large orders for finished material placed during the past six months were sure to affect the pig iron market sooner or later and the large buying of Bessemer iron since the first of the month would indicate that pig iron stocks have been depleted and that large consumers, even though they have great blast furnace capacity must enter the open market in order to keep up their steel production. The largest sale of Bessemer iron noted in many months was made this week to a large Pittsburg steel producer. Considering the fact that deliveries are stretched over a period of five months the price of $12.50 per ton at the furnace is considered a low one. At a meeting of the Bessemer Association to be held in Cleveland this week there is little doubt that the price of Bessemer for delivery in the first half of the year will be fixed. It is expected it will be close to $13 at the furnace. The sales of forge iron during the week will approximate about 4,000 tons at prices ranging from $13.10 to $13.35. In foundry irons there has been little demand, No. 2 selling at $14 to $14.25 in 100-ton lots. We also note the sale of 500 tons of No. 2 at $14, delivered Pittsburg. This iron is for delivery in the next three months. We revise our quotations as follows:

Bessemer, Valley	$12.50 to $13.00
Bessemer, Pittsburg	13.25 to 13.75
No. 1 Foundry	14.50 to 15.00
No. 2 Foundry	14.00 to 14.25
No. 3 Foundry	13.50 to 14.00
Gray Forge, Pittsburg	13.10 to 13.35

FERRO-MANGANESE.—The quotation of $62.50 per ton, car load lots, delivered at buyer's mill is continued by the largest producer. This price is for domestic 80 per cent.

SPELTER.—There has been little demand for spelter here of late, the market being weak and featureless. We quote prime western grades at 4.03½ delivered Pittsburg.

MUCK BARS.—We have been advised of sales amounting to about 2,000 tons. As a result of this demand the price has become somewhat firmer and we quote high-grade muck iron at $25.25 to $25.50, Pittsburg.

SKELP.—The skelp market showed considerable life during the week, a number of round orders having been placed. As a result the market is firmer. We quote grooved iron skelp at 1.55c and sheared at 1.57½c. Steel skelp is held at 1.30c to 1.35c.

STEEL.—The Edgar Thomson steel works of the Carnegie Steel Co. which have been operating on rails for several years, went on billets this week. The mill has caught up on its specifications for rails and as the deliveries on billets were somewhat behind it was decided to run on billets until the deliveries are caught up. Sales of billets during the week amounted to several thousand tons at the agreed prices. Within a week or ten days a meeting of the billet manufacturers will be held in New York and it is believed in some quarters that the prices will then be advanced $1 per ton. Quotations unchanged are as follows: 4x4 billets, delivered, Pittsburg, Wheeling or Valley at $19.75. On less than 4-inch billets down to 1½-inch $1 extra is charged. Open-hearth billets are $1 per ton above Bessemer billets at all delivered points. Sheet and tin bars are $1 above Bessemer billets.

RAILS AND TRACK MATERIAL.—At the meeting of the steel rail manufacturers held in New York last week it was decided to make no change in the price of rails for the present. Another meeting will be held shortly when it is believed in some quarters that an advance will be made to $28. Little new business is being placed and contrary to expectations the Edgar Thomson mill of the Carnegie Steel Co. has been taken off rails and placed on billets, owing to the lack of specifications on rails. The National Steel Co. will resume next week the rolling of rails at its plant at Youngstown, O. Our quotations are as follows: Rails, standard sections, 50 pounds and over, in lots of 200 tons and over, $26; car lots and less than 200 tons, $28; less than car lots, $30; 8 to 12 pounds, $30; 16 to 20 pounds, $29; 25 to 40 pounds, $28. Track material: Spikes, 1.70c to 1.75c; track bolts, square heads, 2.25c; hexagon heads, 2.35c; fish plates, 1.40c to 1.50c.

BARS.—There have been rumors during the week of a weakening in bars. It was stated that prices better than 1.25c were being made for desirable orders. We have been unable to secure anything definite on such prices, while the largest producers deny that any concessions are being made. Little new business on steel bars is being offered, although specifications on running contracts continue to keep the mills in full operation. There seems to be somewhat more effort by valley mills to get business, both in steel and iron. We quote steel bars at 1.25c to 1.30c and common iron bars at 1.35c, delivered, Pittsburg. Refined iron bars are held at 1.75c.

PLATES.—Little new business is being placed in steel plates although the mills of this district continue in full operation on contracts closed last year. Our prices are unchanged, as follows: Tank plate, ¼-inch thick, up to 100 inches in width, 1.40c at mill, Pittsburg; flange and boiler steel, 1.50c; marine, ordinary firebox, A. B. M. A. specifications, 1.60c; still bottom steel, 1.70c; locomotive firebox, not less than 1.90c; and it ranges in price to 3c. Plates more than 100 inches wide, 5 cents extra 100 pounds. Plates 3-16 of an inch in thickness, $1 extra; gauges Nos. 8 and 9, $2 extra. These quotations are based on carload lots, with 5 cents extra a hundred pounds for less than carload lots. Terms, net cash in 30 days.

SHEETS.—Demand for black and galvanized sheets continues strong and prices rule firm in consequence. Our quotations are repeated as follows: Black sheets, No. 28 gauge, one pass through cold rolls, 2.05c to 3c; No. 27, 2.85c to 2.90c; No. 26, 2.70c; No. 24, 2.60c; No. 22, 2.50c; No. 20, 2.40c; No. 18, blue annealed, 2.15c to 2.20c; No. 14, 1.90c to 2c; Nos. 11 and 12, 1.75c to 1.85c; No. 10, 1.65c to 1.70c; plates, gauges 8 and 9, 1.55c to 1.60c. Galvanized sheets continue to be held at 75 off with no freight allowance.

STRUCTURAL MATERIAL.—There is every indication of an immense demand for structural material of all kinds this spring and summer, as a number of large office buildings are to be erected here, ground for which is to be broken shortly. In addition the railroads are planning extensive bridge repairs and replacements which will call for the consumption of considerable material. Prices are unchanged as follows: Beams and channels, 3 to 15 inches, 1.50c; 18 to 24 inches, 1.60c; tees, 1.55c; zees, 1.50c; angles, from 3 to 6 inches, 1.40c; universal mill plates, 1.40c.

PIPES AND TUBES.—The largest producer continues to operate all his mills in full despite the fact that this is considered the dull season in the tubular goods business. Business is reported very good and prices are firm and unchanged. Discounts to consumers in carload lots, Pittsburg, are as follows:

MERCHANT PIPE.

	Black. per cent.	Gal'vd. per cent.
⅛ to ⅜ inch and 11 to 12 inch	61	48
¼ to 10 inch	68½	56

BOILER TUBES.

	22 Feet and under. Per cent.		Over 22 Feet. Per cent.	
	Iron.	Steel.	Iron.	Steel.
1 to 1¾ and 2¼ to 5 inches, inclusive	49½	68¾	44½	65
2 to 2½ inches, inclusive	45	63	39½	59
6 inches and larger	57	62	52½	58

CASING.

	S. and S., per cent.
2 to 3 inches	58
3¼ to 4 inches	63
4½ to 12½ inches	65

O. D. PIPE.

	Per cent.
14 to 22 inches	42
24 inches, o. d. and larger	37

THREADS AND COUPLINGS.

	Per cent.
14 to 16 inches, o. d.	35

MERCHANT STEEL.—Demand for shafting continues strong, despite recent advances, and local mills are pretty well filled up on orders. Prices, however, are unchanged and we make the following quotations: Shafting, carload lots, 55 per cent off, less than car lots, 50 off; tire steel in carload lots and over, 1.40c; less than carload lots, 1.45c to 1.50c. Toe calk is held at 1.50c to 1.55c in large lots, and in small lots as high as 1.60c. Tool steel is held at 7c and upwards according to quality. Hoops and bands, 2c to 2.10c.

WIRE AND WIRE NAILS.—Jobbers report a big demand while the American Steel & Wire Co. reports that the business dur-

ing the past week has been unprecedented for this season. Prices are firm although quotations are unchanged as follows: Single carloads of wire nails to jobbers, $2.20, Pittsburg; to retailers, $2.30. Plain wire, carload lots, is quoted at $2.15 to jobbers, and $2.25 to retailers; painted barb wire, $2.50 in carload lots to jobbers and $2.60 to retailers; galvanized barb wire, $2.80 in carload lots to jobbers and $2.90 to retailers. Cut nails are held at $1.95, Pittsburg, and carload lots with 2 per cent off in 10 days.

OLD MATERIAL.—There is a noticeable softening in the old material market, with indications that prices will go off further within the next ten days. We note the sale of 500 tons of No. 1 railroad wrought scrap at $17 per gross ton, Pittsburg, and sales of several small lots of iron rails at $19 per gross ton. We revise our quotations, gross tons, as follows: No. 1 railroad wrought, $17; car wheels, $16.50; new Bessemer melting stock, $14; iron rails, $19; steel rails, $14.50; busheling scrap, $13.75; borings, $6.75; turnings, $9.

COKE.—Little new business has been placed by furnaces during the past week and the orders taken by the coke manufacturers for foundry coke have not been very numerous. Prices are still weak. We quote Connellsville furnace coke at $1.75 per ton and foundry at $2.25. Outside coke is held at $1.55 to $1.65 for furnace, while foundry is $1.85 to $2.10. For the week ending Saturday, January 12, the total estimated production of the Connellsville region amounted to 194,675 tons, the highest weekly production for about six months. Shipments for the week aggregated 9,257 cars, distributed as follows: To Pittsburg and river tipples, 3,789 cars; to points west of Pittsburg, 3,544 cars; to points east of Connellsville, 1,924 cars. This was a decrease of 71 cars compared with the shipments of the previous week.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1522 MONADNOCK BLOCK, Jan. 22.

Market conditions have been rather quiet in the week under review. While for some grades of iron and steel there has been a good demand with considerable sales, other branches of the market have shown little activity. This, however, has not affected the strength of the situation, as nearly all of the mills and furnaces selling in this territory are well sold ahead, some of them for six months, and they are perfectly willing to let the buyers take their time in getting their supplies. With a few minor exceptions there have been no changes in prices in the week, and it is not expected there will be any immediately.

PIG IRON.—The demand has been light, and almost entirely for small lots. No large transactions have taken place, and while there are one or two good sized buyers in the market, it is not expected they will take any considerable quantities for the present. For what business is going, the furnaces are securing full prices as quoted below, and the market appears strong. The report of a prospective reduction of 20 cents a ton in freight rates from Southern furnaces last week was incorrect. The railroads made an announcement to that effect, but it was later discovered that it applied only on iron and steel from markets east of here to Chicago points, and not from the Southern furnaces. The rate from the South remains at $3.85 on pig iron. Quotations are unchanged as follows:

Lake Sup. Charcoal	$18 50 to $19 50	Southern Coke No. 4	$13 60 to $14 10
Local Coke Fdy. No. 1	15 50 to 16 00	Southern No. 1 Soft	15 10 to 15 60
Local Coke Fdy. No. 2	14 50 to 15 00	Southern No. 2 Soft	14 60 to 15 10
Local Coke Fdy. No. 3	14 00 to 14 50	Southern Silveries	15 50 to 16 00
Local Scotch Fdy. No. 1	15 50 to 16 00	Jackson Co. Silveries	17 50 to 18 50
Local Scotch Fdy. No. 2	14 50 to 15 00	Ohio Strong Softeners	15 75 to 16 25
Local Scotch Fdy. No. 3	14 00 to 14 50	Alabama Car Wheel	21 00 to 22 00
Southern Coke No. 1	15 10 to 15 60	Malleable Bessemer	15 00 to 15 50
Southern Coke No. 2	14 60 to 15 10	Coke Bessemer	15 00 to 15 50
Southern Coke No. 3	14 10 to 14 60		

BARS.—The demand continues large for steel, and some good sales were made in the week. Several of the Western mills, including those in this city, are practically out of the market for the present except for small lots, and as a consequence the market is very strong. A few mills report some trouble in keeping shipments up with specifications. Bar iron is in nearly as good condition. The mills report a good tonnage of orders closed, and that they have their order books well filled for some time ahead. Prices are unchanged and very firm at 1.45c to 1.50c, half extras, Chicago, for both iron and steel.

STRUCTURAL MATERIAL.—There have been no sales of importance, and it is not expected any large contracts will be placed immediately, although there are several that may come in at any time, and will undoubtedly be placed shortly. Sales of small lots in the week made a fair total. Quotations are unchanged as follows: Beams 15 inches and under, 1.65c; 18 inches and over, 1.75c; angles under three inches, 1.40c to 1.45c; over six inches, 1.65c; three inches to six inches, 1.55c; plates, 1.55c; tees, 1.70c; zees, 1.65c; small lots from store are quoted ¼c to ½c higher.

RAILS AND TRACK SUPPLIES.—Some few small sales of standard sections were made in the week, but nothing of importance was closed. There are several good contracts in sight which may be placed at any time. The probability of an advance in prices is still being discussed. Quotations are as follows: Rails, standard sections, $26; light sections, $26 to $28; splice bars, 1.40c to 1.50c; spikes, 1.70c to 1.75c; track bolts, hexagon nuts, 2.55c to 2.60c; square nuts, 2.40c to 2.50c.

PLATES.—Nothing large was closed in the week, but there was a fair run of small and medium sized orders. The demand is excellent, and several quite large contracts are in sight for the near future. Prices are made as follows, mill shipment, Chicago delivery: Tank steel, 1.55c; flange steel, 1.65c; marine steel, 1.75c; fire-box steel, ordinary, 1.75c; fire-box, special, 2.25c and upwards.

BILLETS AND RODS.—The market is quiet, with only a few small sales of steel. The quotation is still made of $20.75 for Bessemer billets.

SHEETS.—The demand continues large, and sales last week were fully up to those of any recent week, making a large tonnage closed. Both jobbers and consumers were large buyers. Quotations are very firm and unchanged at 3.18c for No. 27 black, and 70 and 10 per cent off for galvanized mill shipment.

MERCHANT STEEL.—The situation is unchanged. The demand is not large, but as the mills have heavy orders booked they are well satisfied with a quiet period. Quotations are as follows, mill shipments, Chicago delivery: Smooth-finished tire steel 1.75c to 1.85c; open-hearth spring steel, 2.15c to 2.35c; toe calk, 2.40c to 2.55c; sleigh shoe, 1.70c to 1.80c; cutter shoe, 2.40c to 2.55c; ordinary tool steel, 6c to 7c; specials, 13c and upwards.

MERCHANT PIPE.—The demand is excellent for the season, and sales have aggregated a very fair tonnage in the week. Prospects for the future are good. Random lengths, Chicago delivery, are quoted as follows:

MERCHANT PIPE.

	Carload lots.		Less than carload lots	
	Black	Galv.	Black	Galv.
	Per cent.	Per cent.	Per cent.	Per cent.
⅛ to ½ and 11 to 12 in	59.2	46.2	54.9	40.9
¾ to 10 inches	66.7	53.3	61.9	49.9

WIRE AND WIRE NAILS.—The demand continues large and sales last week were of good volume. Mills are behind on their orders in some descriptions of wire goods, and the market is very strong. Makers quote single carloads of wire nails at $2.48 f. o. b. Chicago, and $2.63 for less than carloads. On wire, current quotations are as follows: Plain annealed wire, $2.43; painted barb wire, $2.78; galvanized barb wire, $3.08.

OLD MATERIAL.—Consumers are not taking hold very well, and sales last week were not especially large. One or two good contracts only were closed. Two of the railroads will sell an aggregate of about 9,000 tons of old material on Thursday of this week. Railroad offerings have been very large since the first of the year, but up to date have been easily absorbed. The following are dealers' selling prices per gross ton:

Old iron rails	$18 50 to $19 00	Old wheels	16 00 to 17 00
Old steel rails, long	15 00	Heavy melting steel	10 50 to 11 00
Old steel rails, mixed	11 00 to 12 00	Mixed country steel	9 50 to 10 00
Relaying rails	20 00 to 22 00		

The following prices are per net ton:

No. 1 R. R. wrought	14 50 to 15 00	Cast borings	3 00 to 3 50
Dealer's forge	12 50 to 13 00	Wrought turnings	7 25 to 7 50
No. 1 cut mill	9 75 to 10 00	Iron axle turnings	9 00 to 9 50
Heavy cast	11 50 to 12 00	Steel axle turnings	8 00 to 8 50
Railway malleable	11 50 to 12 00	Stove plates	7 50 to 8 00
Country malleable	9 75 to 10 00	Old iron splice bars	16 00 to 16 50
Iron axles	18 00 to 19 00		

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
CAXTON BUILDING, Jan. 23.

The trade has come to the last week in January which uninformed rumor had scheduled as the time for taking up ore

matters for 1901; but there seems no more disposition to consider prices and outputs than at the close of the shipping season of 1900. The amount of Bessemer iron that will be wanted in the coming year apart from that produced in the furnaces of the large steel makers, is a factor that cannot be determined even in a general way as yet. If this question could be answered, some interest in the ore basis for 1901 might be shown by merchant furnacemen; but it is not in evidence yet. A good many things must be considered by the ore men themselves in trying to come at a fair price for old-range ores. The companies mining ore for sale in the open market may not find their interests identical with those of some of the large producer-consumers. If the latter should stand for a high price that would tend to curtail sales of the merchant ore men, the problem raised might not be easy of adjustment. The necessity for a moderate base figure is becoming better recognized, as time passes, the export trade in the case of Bessemer material, and Southern competition, in the case of non-Bessemer, being considerations that will not be disregarded.

PIG IRON.—The purchases of Bessemer iron by Pittsburg interests last week, much of the metal being for early delivery, made a considerable inroad upon stocks and valley furnaces. Following these has come in the last few days a purchase of 100,000 tons by the leading Pittsburg interest, deliveries extending to the middle of the year. The price paid, understood to be $12.50 at valley furnace, certainly leaves no profit to any but the best equipped furnaces, at the prices paid for the ores that will be used up to May 1, and new ore will be available only on the last two months of the contract. The transaction is on a par with some of the contracts for steel bars made last summer—so palpably touching cost that there could not be the slightest hesitation on the part of the buyer in contracting on that basis. They may be regarded as signifying the furnacemen's desire to operate their stacks, many of which have been shut down for months, the price being secondary to the consideration of giving a needed stimulus to the market. The price, it goes without saying, implies a wage considerably lower than has ruled for the past 18 months; and if there had been a sliding scale arrangement between furnacemen and furnace workmen such as obtains in the mills, the reduction scheduled for Feb. 1 would have come long ago. Foundry iron has been quiet, with prices ranging from $13.25 to $13.50 for No. 2 at Valley furnace. Some business has been done in basic iron, which is quoted at $12.75 to $13 at valley furnace. We revise quotations as follows:

Bessemer	$13 25 to $13 75	Valley Scotch No. 1	$14 75 to $15 00
No. 1 Strong F'dry	14 75 to 15 00	Valley Scotch No. 2	14 25 to 14 50
No. 2 Strong F'dry	14 00 to 14 50	Gray forge, valley	12 50 to 12 75
No. 3 Foundry	13 50 to 14 00	Lakes perior charc'l	17 00 to 17 50

FINISHED MATERIAL.—If there is any change in the situation—and it is not decisive—there is slightly more effort by one or two producers to get business in bars, particularly bar iron, and a slight easing up of the situation so far as some of the plate mills are concerned. It is understood that the ability of plate mills to make deliveries ranges all the way from two weeks to seven months' engagements, the latter being the situation of the leading interest at Pittsburg. Additional ship yard work reported in the week means more demand for plates, but nothing immediate. We quote bar iron at 1.25c, Valley mill, and steel bars have been slightly easier, though leading interests whose order books are well filled, are maintaining 1.25c Pittsburg as minimum, with 1.30c asked for small lots. Other mills report specifications not quite so plentiful in both iron and steel bars. A contract for 5,000 tons of rails for an electric line was placed in the week, and rail mills are only quoting on each lot as it comes up, prices being subject to withdrawal. It is now thought an advance will be made on Feb. 1. Structural material is rather quiet, an 800-ton contract being the largest locally for the week. The outlook for the spring continues good, however. Sheets are unchanged, ordinary lots being sold at 3c at mill for No. 28, one pass through cold rolls.

OLD MATERIAL.—Demand is light and the market is heavy, with slightly lower prices on some materials. Little interest is shown either by mills or foundries, and some dealers, who have been holding prices well under the conditions recently existing, are disposed to realize on a portion of their stocks. We quote Cleveland deliveries as follows, gross tons: Old iron rails, $18 to $18.50; old steel rails, 6 ft. and over, $13 to $13.50; old steel rails, short lengths, $11.50; old car wheels, $14.50 to $15; No. 1 railroad wrought, $15.50 to $16; mill scrap, $13 to $13.50; No. 1 machine cast scrap, $13; iron axles, $21 to $22; axle turnings, $10.50; wrought turnings, $9.50; cast borings, $5.50; grate bars, $7.50 to $8; wrought drillings, $8; stove plate, $7.50.

CINCINNATI.

Jan. 22.

The extent of the demand that comes up without any special noise, is the comment of the local pig iron selling firms. Matthew Addy & Co. say of the past week: "The month, as was predicted, has shown steadily progressive activity in the pig iron market. There has been during the past week more buying than in the week which preceded it, and the prospects just ahead are excellent. Inquiry keeps up with a regularity that is very satisfactory. This inquiry is exceedingly general in character, every kind of iron being in fair demand, the only slackness anywhere being in the matter of gray forge and mottled. With these exceptions there have been good sales all along the line. The big buyers last week make a determined and simultaneous attack on the market. They were hunting for weak places, but it cannot be said that they were successful in any marked degree. There are few furnace companies under any pressure to sell. One or two little speculative lots have been disposed of, and this is really to the great benefit of the market, as the field has been left clear for legitimate trade. The requests for hurry shipments on back orders continue pressing. In fact, these requests are more imperative than ever, and they bear eloquent testimony to the fact that the foundries are busy and that they have no reserve stocks of iron on hand. There is but little iron in consumers' yards, and this is a great element of strength, as it means that pig metal must be bought right along. We see every reason to expect a continuance of the regular buying that is now the feature of the market."

Rogers, Brown & Co., reviewing the situation, write as follows: "The past week has shown more activity than the preceding weeks of this year. The pipe companies in this vicinity have secured quite a number of large contracts, and are preparing to operate their works in full. They have been in the market this week, and made large purchases for early delivery. Pig iron stocks decreased in December about 28,000 tons ,although production in December was 120,000 tons more than in November. This shows plainly that consumption is ahead of production in the usually dullest month of the year. The reports seem to indicate that there will be a strike of furnacemen in Mahoning and Shenango valley districts, which will cause the banking of a great many furnaces. Anyhow, the likelihood of the strike has increased the sale and demand for Bessemer iron. As for Southern irons, most Birmingham furnaces claim to be holding firm at $11 Birmingham, for No. 2 foundry, while the Tennessee furnaces have been shading this price 25 to 50 cents per ton. The inquiry is large, and with a few more sales at prices that have been made last week, we look for a firmer tone to the market."

We quote for cash f. o. b. cars Cincinnati: Southern coke, No. 1 foundry, $13.75 to $14.25; No. 2 foundry, $13.25 to $13.75; No. 3 foundry, $13 to $13.25; No. 4 foundry, $12 to $12.50; gray forge, $12 to $12.25; No. 1 soft, $13.75 to $14.25; No. 2 soft, $13.25 to $13.75; Lake Superior Coke, No. 1, $15.25 to $15.50; No. 2, $14.25 to $14.50; Hanging Rock charcoal, No. 1, $19.50 to $20; Jackson Co. silvery, No. 1, $17 to $17.25; Standard Georgia car wheel, $18.75 to $19.50; Lake Superior charcoal, $19 to $20.

PHILADELPHIA.

Jan. 22.

No great activity in new business has been apparent during the week. Furnaces and mills are still behind with deliveries in many cases. Buyers are urging deliveries of material placed some time ago, but are in no hurry to close new contracts for far-ahead deliveries, in face of the expected decrease in cost of production, and the reduction in freight rates soon to take effect. The recent reports of changes in the great iron and steel companies have had little effect though that little has not been in the direction of strength. Under all the stories stock quotations remain without any marked changes.

PIG IRON.—Pressure is being put upon the furnaces by buyers to secure delivery of iron bought at early fall quotations.

In general the only orders booked at present are for iron for immediate consumption. The better brands still continue scarce. Today's quotations are not as significant as might at first appear, in view of the inability of producers to catch up on back orders. Buyers appear to believe that lower figures will soon prevail and are looking for weak places. Quotations are the same as last week's, but for a desirable order it is probable that these would be shaded somewhat. We quote: No. 1 X foundry, $16 to $16.50; No. 2 X foundry, $15.50 to $16; No. 2 plain, $15 to $15.25; gray forge, standard brand, $14 to $14.25.

FINISHED MATERIAL.—Some let-down in the volume of business is noticeable, but mills are still tolerably well supplied. If all the options out among shipyards and other larger consumers were taken up, mills would have work enough to last well into the summer. Prices hold steady in all lines, while in sheets a slight advance has been made. Plate mills are making more effort for business of late. Quotations are as follows: Best refined iron bars, 1.45c to 1.55c; steel bars, 1.40c to 1.50c; plates, ¼-inch thicker, 1.55c to 1.60c; beams and channels, 1.65c to 1.75c; sheets, mill shipments, one pass through cold rolls, No. 10, 2.05c; No. 14, 2.25c; No. 16, 2.45c; Nos. 18-20, 2.95c; No. 24, 3.05c; No. 26, 3.10c; No. 28, 3.25c to 3.30c.

OLD MATERIAL.—Demand is good and prices firm. The uncertainty of the past few weeks has died out, leaving a more normal tone to the market. There is marked strength in choice heavy steel scrap. We quote: Choice railroad scrap, $17.50 to $18; No. 1 yard scrap, ordinary, $14 to $15; No. 2, light scrap, $12 to $12.50; machinery cast, $14.50 to $15; heavy steel scrap, $15 to $16.25; old iron rails, $17.50 to $18; old steel rails, $15 to $15.50; wrought turnings, $10 to $11; cast borings, $8 to $8.25; old car wheels, $17.50 to $18.

BIRMINGHAM, ALA.

Jan. 21

No new features have developed in the local iron market since the beginning of the new year, the demand continuing fair and the sales about equaling the make of the furnaces. The sales so far made this year are mostly of small quantities, with few of them running as high as 500 tons. Local quotations remain the same as in the latter part of December, and the market is firm. One manufacturer states that concessions of about 25 cents a ton might be made on large lots, of say 1,000 tons or more, and not for immediate delivery. The make of the furnaces in the Birmingham district is practically sold for several months ahead. No. 2 foundry is still quoted at $11 and other grades in proportion. Tennessee irons are reported to shade this price somewhat.

The Ensley steel mill of the Tennessee Coal, Iron & Railroad Co., shipped 3,000 tons of billets for export to Glasgow, Scotland, in the week just past, the metal going by New Orleans. This, however, is but one of several shipments made by the same company to Glasgow since the latter part of last summer.

Pig iron shipments from the Birmingham district in 1900, according to the report of the Southern Iron Committee, aggregated 817,972 tons, an increase of 71,946 tons over the year 1899. The same report shows that during the year 1900 export iron from Alabama aggregated 238,615 tons, an increase of about 12,000 tons over the exports in 1899. Nine-tenths of the export iron was shipped from the Birmingham district.

It is reported in a telegram from Talladega that Eugene Zimmerman has disposed of his furnace, mineral land and railroad interests in Alabama. The properties consisted of a coke furnace at Talladega, ore lands in Talladega County, and the Birmingham & Atlantic Railroad, a line about twenty miles long running from Talladega to Pell City. Ladenberg, Thalmann & Co. of New York, are the purchasers. The telegram states that the repairs begun on the furnace last fall will be completed at once, and the furnace put in blast by the middle of February. Mr. Zimmerman recently sold the furnace at Decatur, Ala., which came into his possession about two years, to E. M. Tutwiler, owner of the Tutwiler Coal, Coke & Iron Co. of this city.

The plant of the Birmingham Cement Co. at Ensley has been started up. The original plant of this company was destroyed by fire last summer, and the one now in operation is a duplicate of the first. Furnace slag is used in making the cement.

John C. Brain, who represents New York capital, has been in the city the past two weeks in the interest of a new fertilizer company that purposes building five factories in this country. The first one is to be built at North Birmingham; the second one at Copley, Pa.; the third at Sparrows Point, Md.; the fourth at Chattanooga, and the fifth at some point on the Pacific coast. Blast furnace slag will be utilized as the base for the fertilizer, which will be known as Brainite. Mr. Brain states that he has secured fifteen acres of land at North Birmingham on which the plant will be located. Work on the construction of the buildings will begin in a few weeks.

W. J. B.

LAKE SUPERIOR IRON MINES.

The Bucyrus Co., South Milwaukee, Wis., refers to the performance of its steam shovels at the Biwabik mine last year. There are three shovels, two of which are 85-ton and one 65-ton. These mined in the season from its natural bed 915,000 gross tons of ore, working day shift. In a single month they mined 205,000 tons. One of these (the 65-ton), in ten hours loaded 185 twenty-nine-ton cars, or 5,365 gross tons.

For the first time since the opening of the Jackson mine, at Negaunee, Mich., more than 50 years ago, operations have been entirely suspended. The mine has never once since its inception missed paying its men on the regular pay day. There are yet extensive deposits of low grade ore, which had a market value last year, and may have this year. In this event, employment will be given to a number of men.

By spring the Ontario & Rainy River Railway will have a line completed into the Atikokan district, the Canadian ore field. Ore docks and complete equipment for handling the ore will be built on Thunder bay.

E. F. Bradt, formerly manager of the explorations for the Manila Iron Co., is in charge of the explorations being made by the American Steel & Wire Co., on the Atikokan range. The company has an option to purchase 3 miles along the range for $500,000, and will explore thoroughly. The ore is of magnetic quality, of high grade and very low in phosphorus, and will prove an important addition to the Bessemer supplies. The Canadian Northern railroad, which has a line in the range, has agreed to make a rate of a half cent per ton per mile to the docks at the Canadian head of Lake Superior, and to provide dock facilities. The rate to dock will be about 70 cents per ton. The cost of lake transportation to Lake Erie ports will be about the same as from Duluth.

The stripping contract at the Biwabik mine in the Mesabi district, lately finished by the Drake & Stratton Co., brings the stripping line close to the Cincinnati mine on the southeast. Much stripping still remains, which will be done probably in the next two years. When operations begin again at the mine, the eastern outlet will be abandoned, and the high bank of ore there will be mined away. The stripping company removed 1,200,000 cu. yds. of earth last year. The mine is expected to produce 1,000,000 tons of ore this year.

Mining has been resumed at the Stevenson mine on the Mesabi range, and will probably continue all winter. A force of 25 men is employed at No. 2 shaft, which has a daily capacity of 800 tons. It is probable that later on mining will be carried on through No. 1 shaft, doubling the present output. The stripping portion of the mine is not yet in condition to admit of exploitation, but No. 3 shaft can be commissioned when necessary.

A large deposit of ore was proved up last season in the Chisholm mine, near Hibbing, Minn., on the Mesabi range, and preparations are being made for heavy shipments this season. The Chisholm Iron Co., owner of the property, has machinery ready to be installed, and a shaft will be sunk as soon as possible. Archie Chisholm, of Hibbing; John Mitchell, of Winona, and M. L. Fay, of Virginia, are the principals in the company.

The Columbia Mining Co., with capital of $50,000, has been incoroprated by Captain Harry Roberts, W. T. Bailey, Joseph Sellwood and James Sullivan, to operate the new Columbia mine, formerly the Humphrey Forty, on the outskirts of Virginia, Minn. It was exploited last season by A. E. Humphrey, owner of the fee, and a valuable body of ore shown up. A lease was secured by Capt. Roberts last fall. The ore is coarse in grain and runs 62 per cent in iron and 0.03 in phosphorus. Two No. 10 Cameron pumps have been installed, as considerable trouble has been given by water. The ore will be carried to the docks by the Eastern Minnesota railroad.

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AND
INDUSTRIAL WORLD.

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JANUARY 24, 1901.

TWO YEARS OF CONSOLIDATION IN TIN PLATE.

The remarkable showing which has just been made by the American Tin Plate Co. is only in line with the series of surprises which the tin plate industry has shown ever since its establishment upon American soil. Although the phenomenal growth of the industry had brought prices down to a level permitting only the most meager profits, the success of the promoters of the American Tin Plate Co. was a surprise to the trade, while the remarkable success of the company since its formation has been contrary to the predictions of all who were not personally interested in it. It was generally expected that within two years the company would have a large amount of outside competition to reckon with, yet the fact is that none of the iron and steel consolidations of about the same age has as little competition today as the American Tin Plate Co., although none has been threatened with more. Scarcely a week has passed that the daily press has not reported some new scheme to build a tin plate mil. It is probable that the very plethora of projects has frightened capitalists. The schemes for tin mill building have generally been the creation of men whose lack of capital was only equaled by their lack of knowledge of the business, and their projects having come to naught the whole idea of tin mill erection has been given a bad name.

Since the formation of the consolidation only three plants of commercial importance have been erected. Two of these, the tin plate plant of the National Enameling & Stamping Co. and the black plate mill leased by the N. & G. Taylor Co., have been to supply material for already established consuming interests, and not for the general market. The third plant, at Muskegon, Mich., has just been purchased by the consolidation, this being the only purchase of a competitor the company has found it desirable to make.

The very erratic course of the market in the past two years for the tin plate industry's two chief raw materials, tin plate bars and pig tin, has entirely prevented any close estimate as to the spread between cost and selling price of tin plate, added to which is the fact that in neither line has the company paid current market prices. Through its association with the National Steel Co. tin plate bars have unquestionably been secured below current market prices and advantageous future contracts have doubtless been the rule. Despite reports to the contrary, it may safely be said that the American Tin Plate Co. has no direct control over the pig tin supply, but with its very large consumption it has been able to make wise future purchases, which purchases would naturally be followed by advances in the open market, the force of which would be about spent by the time the company was ready to contract for a further supply. In regard to expected economies from centralized management, there is reason to believe the company's experience has bee nvery satisfactory. So many widely different processes are involved in tin plate making that an exceptional field has been presented for applying to all the mills small economies discovered in one or the other of them. The roll makers state that the consumption of chill rolls has been very greatly reduced.

It must be noted also that the total value of annual product in proportion to investment is comparatively high in tin plate. The production of the company last year may be taken roughly at 900,000,000 pounds, which brought an average price at mill, allowing for the different grades and weights, of about 4.65c a pound, or $41,850,000. The dividends to be paid this year, 7 per cent on $18,325,000 of preferred stock and 8 per cent on $28,000,000 of common stock, amount to $3,522,750. This represents only 8.4 per cent on the value of the product of 1900. Private iron and steel enterprises have frequently distributed to their stockholders profits representing a much larger percentage on the annual business.

WAR AND PEACE RUMORS.

Not since the early months of 1899, when Wall Street was in a furore over the tales of iron trade amalgamations, that were to roll consolidations into yet greater consolidations, and finally into an all-inclusive steel trust of fabulous capitalization and equally fabulous control of sources of supply, has the trade been so beset with rumors of great import as in the past week. We referred last week to the bearing of the Carnegie plan for a great wrought pipe works at Conneaut, O., upon the relations existing between the various leading producers of steel. That the carrying out of this plan means a disastrous price war among large concerns and the inauguration of a general policy of invasion and retaliation, we do not believe. There has been a vast amount of sensational rubbish dumped upon the reading public in the past two or three weeks, most of it for stock market effect, no doubt; but the tendency of all such publications is to beget a feeling of distrust concerning the conditions in the iron trade that is not warranted.

The idea that present lines, both as to volume and kind of output by each of the leading concerns, must be preserved intact, or the entire trade will be plunged into a destructive war, is unreasonable and misleading. The iron industry is the last of all industries to be expected to crystallize. Its evolution in the past 10 years has been amazing, and yet these changes, which have involved the entrance of old producers upon new fields

and of entirely new companies upon lines which well-established companies had followed for years, have not prevented well managed concerns from making good profits in years when the whole country was not in the grasp of depression.

As for the latest reports, the evident purpose of which was to undo some of the harm done by the mad-cap publications concerning the policy of the Carnegie Steel Co., there does not seem at this writing to be any substantial basis for any of them. Mr. Carnegie has said that no proposition had been made to him recently to buy a controlling interest in his company, and the report that he had given an option on his holdings at $200,000,000 to persons interested in protecting the National Tube Co., with its $80,000,000 capitalization, may be treated as fanciful. Scarcely more ground appears for the report that the Federal Steel Co. will use a $14,000,000 bond issue to acquire control of the American Steel & Wire Co., with its $90,000,000 of capital. It is more reasonable to suppose that the Federal Steel Co. will devote any bond issue it may make to increasing its outlets in finished material, by the erection of a structural plant, for example, than that it should make so large an expenditure to insure an outlet for its rods, which it is likely to have without any such outlay.

The hasty writing on the state of war into which we are told the great steel companies are hurrying, has lost sight of the fact that the men foremost in the industry are in it for profit, and not for retaliatory warfare or annihilation. The field of our steel makers is the world, and the ranks of the well-equipped producers are not yet so crowded that any must be got rid of that the others may prosper. The regular swing of the pendulum may bring the iron industry to the point of over production again, as in the past, but such a condition will be reached gradually, as always, and it will come because there has been an over-building of plant in the effort to get profits, not because manufacturers have planned a campaign of aggression or retaliation against the interests of others in the business. Considering the remoteness of its bearing on the trade of 1901 there has been altogether too much of war talk since the opening of the new year.

Union Molders Resist Their Union.

At Chicago 150 molders in the Fraser & Chalmers foundry are out on a strike. The men demanded the discharge of the general superintendent, who they said was responsible for the discharge of six union molders. The company had agreed to reinstate the six men pending an investigation of the matter, but the men demanded the superintendent's discharge before they would go to work. President Fox of the Iron Molders' Union, was appealed to and he ordered the men all back pending negotiations. This they refused to do. The matter is still pending. The claim of the molders that the issue is an individual and local one and one on which they are not subject to control of the union is most extraordinary. President Fox, with the fairness and good judgment for which he has become known, directed the business agent of the union, who was on the ground, to persuade the men to return to work, characterizing their action as impulsive and arbitrary. Later, it is understood, Vice-President Valentine went to Chicago and held several meetings with the men, but without inducing them to give up their position.

The men thus not only violate the New York agreement, but defy the constituted authorities of their own organization. Their national officers have threatened to take away the charter of the local union and have suggested that the shop might be thrown open to other union men. The probabilities are, however, that in such an event other union men would refuse to take the strikers' places. The proposal to open the shop to non-union men is one that the firm would have every justification in entertaining. The case is apt to set foundrymen to thinking concerning the value of an agreement that may be thus abrogated at the whim of a local organization which chooses to exempt its particular grievance from the proviso that work shall continue pending the adjustment of any and all disputes. The whole basis of agreements between national organizations is swept away before such a shameless exhibition of bad faith. If the Iron Molders' Union desires to be regarded as an organization with power to enforce justice and not merely as a fighting machine to bombard employers with its demands, it will make an example of these Chicago strikers. One such performance will do more to prejudice the union with employers, than can be undone in many arbitrations.

American Tin Plate Co. Takes Sharon Output.

(Special Telegram.)

PITTSBURG, Jan 23.— At a meeting of the stockholders of the Sharon Steel Co., held yesterday, the executive committee of the Sharon Tin Plate Co., an allied corporation, was instructed to enter into a contract with the American Tin Plate Co. for the purchase of the entire output of the 20-mill tin plant for a term of five years. This action removes one of the American Tin Plate Co.'s chief competitors.

The executive committee of the Sharon Steel Co. was also authorized to award contracts for the erection of pipe and skelp mills at South Sharon, Pa. The new mill will have a daily capacity of 400 tons of basic steel tubes. Pipes up to 12 inches in diameter will be manufactured. The tin plate plant of the company will be placed in operation by April 15, while the new blast furnace, with a daily capacity of 600 tons, will be ready for operation in three months. It is reported that the American Steel and Wire Co. is negotiating for the purchase of the output of the Sharon Steel Co.'s wire and wire nail plants.

Tin Plate Contracts for Second Quarter.

(Special Telegram.)

PITTSBURG, Jan. 23.— The American Tin Plate Co. has announced to the trade that it will book for the second quarter or up to July 1, at prices now ruling, which are on the basis of $4 for 100-pound boxes of coke plates at mill.

N. P. Bowler, Washington W. Balkwill and Wm. Bowler, members of the firm of Bowler & Co., which has carried on the foundry business in Cleveland for 38 years, announce their retirement and the sale of the plant and business to the Bowler Foundry Co., recently incorporated.

No. 3 furnace of the Eliza group, of Jones & Laughlins, Ltd., recently completed, was blown in for the first time this week. The furnace has a capacity of about 600 tons daily, and together with the Soho furnace and the two other large furnaces recently completed, the daily output of pig iron of Jones & Laughlins furnaces is about 2,200 tons. The fourth furnace of this group will be completed within about three months.

It is reported that contracts will soon be let for the construction of the plant of the Eastern Tube Works, at Zanesville, O., and which is chartered in the State of West Virginia with a capital of $1,000,000. The product of the plant will include lap and butt weld pipe, both black and galvanized. A large bonus was secured from the citizens of Zanesville. The stock is largely held by Eastern capitalists.

It has been announced that the Republic Iron & Steel Co. will commence the work of building two new mills at the Brown-Bonnell plant at Youngstown, O., about the middle of March. The new mills will consist of a guide mill and a continuous hoop mill.

As a result of the bi-monthly examination of the sales sheets of the American Tin Plate Co., there will be no change in the wages of the tin workers of the Amalgamated Association for the months of January and February. Prices averaged $4 per box.

PERSONAL.

Among Americans who received decorations of the Legion of Honor in connection with the Paris Exposition are the following well known in the iron and steel and engineering trades: Cyrus H. McCormick, Wm. Deering, James W. Duntley, Frederick V. Skiff, Chas. A. Moore, Henry M. Howe, Chas. T. Schoen, Ambrose Swasey and George Westinghouse.

William T. Hardesty, for many years master mechanic of the Falcon Iron & Nail Co., at Niles, O., has been appointed general superintendent of the plants of the American Sheet Steel Co. at Niles.

R. R. Richardson, heretofore at the Duquesne works of the Carnegie Steel Co., has succeeded Frank Sleath as superindendent of the docks at Conneaut, O.

With the opening of the new year, Wm. G. Gray, who has been assistant to General Manager Swank, of the American Iron and Steel Association for a number of years, was appointed statistician of the association, and he will continue the statistical work of the association upon its well-known lines. Mr. Gray is now supervising also the collection of the iron and steel statistics for the census of 1900. In announcing Mr. Gray's appointment as statistician, Mr. Swank makes this personal reference which, because of what it suggests, will be read regretfully by his friends everywhere. The 28 years have been full of hard work and of unceasing devotion to every interest of the American iron trade: "Having ourselves completed twenty-eight years of continuous service as the executive head of the American Iron and Steel Association and as the editor of its publications our friends in the Association will no longer expect us to give that attention to the details of office work that we have heretofore done. During the remainder of our connection with the Association we will, however, continue to guard all its interests as carefully as we have done in the past. Its general management, its financial affairs, the editing of the *Bulletin*, etc., will receive all the attention we have heretofore given to them."

The American Bridge Co. has grouped all its Eastern plants in one section, and appointed A. J. Major, formerly manager of the bridge and construction department of the A. & P. Roberts Co., as manager of all these plants, which include the following: The Pencoyd, the East Berlin, the Buffalo, the Edge Moor, the Elmira, the Groton, the Hilton, the Horseheads, the Trenton, the Post & McCord, the Rochester, and the Union plants.

J. M. Van Harlingen, lately connected with the Republic Iron & Steel Co., at Chicago, and formerly identified with the Ohio Steel Co., and in turn with the National Steel Co., at Youngstown, O., has been engaged to travel for the American Steel Hoop Co., under the direction of the Cincinnati district sales agent, Samuel Siddall.

An error was made in the recent reference in these columns to the tin plate plant of the Champion Iron & Steel Co. The erection of the mills was under the direction of Theo. D. Morgan, who has been general manager since the plant was started. D. B. Scully, of Chicago, who was mentioned in this connection, is a director of the company.

J. B. Wikoff, of Cambridge, O. has been appointed general manager of the Cambridge, O., plant of the American Sheet Steel Co.

The Carnegie Institute of Pittsburg received last week a $1,000,000 bond from Andrew Carnegie. Several years ago Mr. Carnegie endowed the Institute with this sum, and has yearly paid the trustees $50,000. The bond is one of those issued by the Carnegie Co., and bears interest at 5 per cent.

President O. P. Letchworth, of the Pratt & Letchworth Co., Buffalo, was elected president of the Buffalo Board of Trade last week. Mr. Letchworth was a reluctant recipient of the honor, but the unanimity with which it was bestowed, and the stress put upon his acceptance in view of the duties the president of the board will be called upon to perform in the Pan American Exposition year, finally prevailed. Buffalo's commercial and industrial interests are fortunate to be so represented.

In leaving Minnesota to go to New York last week Chairman-elect Bacon, of the Tennessee Coal, Iron & Railroad Co., was presented with a handsome diamond ring by his long-time associates in the Minnesota Iron Co., and was dined by a number of prominent residents of Duluth.

W. E. Corey, superintendent of the Homestead Steel Works, Howard Axle Works and the Carrie furnaces of the Carnegie Steel Co., was tendered a banquet at the Hotel Schenley, Pittsburg, Saturday evening, Jan. 19, by the superintendents' club of the Carnegie Steel Co. Mr. Corey was presented with a gold-mounted vase. He sailed this week for Genoa, Italy.

John W. Harrison, for 32 years a member of the firm of Shickle, Harrison & Howard Iron Co., of St. Louis, Mo., disposed of his interest in the company last week, and will retire from active business entirely. Mr. Harrison was born in Howard county, Mo., and after graduating from the Missouri State University became manager of a plant at Ironton, Mo., where large quantities of shot and shell were turned out during the Civil war. In 1868 he entered upon the business from which he has just retired.

John L. Smith, superintendent of the Indiana district of the Republic Iron & Steel Co., William M. Myers, formerly secretary of the Indiana Iron Co., Muncie, Ind., and Superintendent W. C. Ely, of the Marion, Ind., works, have resigned. It is reported that they are promoting a rolling mill company at Terre Haute, Ind.

Core-Makers' Strike in Cleveland.

The effort of Cleveland machinery founders and their core-makers to arrive at an agreement for the year 1901 has failed in the past week and on Tuesday the core-makers in all but two or three foundries went out on strike. Toward the end of last year both sides gave notice of a desire for a new agreement. There had been a minimum wage in 1900 of $2.50 for a 10-hour day. A close limitation was put upon the number of apprentices—one to eight journeymen—and so-called handy men, who are regarded perfectly competent to do certain kinds of work though not skilled core-makers, were ruled out. The core-makers' union sought to make the agreement for 1901 rather more stringent in its regulations than that of last year; the employers offered instead the agreement entered into at Milwaukee last year between the union core-makers and the foundrymen. The Cleveland core-makers refused to accept this, objecting particularly to three paragraphs. One reads: "It is understood that there is nothing in this agreement that will prevent the employment of other workmen and boys to make such cores as they may be competent to make at a lower rate of wages." The second provides that foremen core-makers shall not be members of the core-makers' union. The third makes the foreman or superintendent of the foundry the judge of the skill of the core-maker and his competence to receive the minimum wage.

A number of conferences were held without agreement. As a compromise it was finally suggested by the foundrymen that the old agreement continue in force indefinitely and that further effort be made to come to an understanding on the points at issue. The union's answer to this was the strike. The president of the International Core Makers' Union is expected on the ground and effort at adjustment of the matter may be resumed.

The Wheeling Mold & Foundry Co. of Wheeling, W. Va., one of the best known and longest established foundries in the Wheeling district, will erect a foundry and machine shop for the manufacture of sand and chilled rolls, rolling mill machinery and general structural castings. It is estimated that the new plant will occupy approximately three acres. The site has not yet been selected, although several options have been secured. The present capital stock of the Wheeling Mold & Foundry Co. is to be largely increased, the additional stock already having been placed with Wheeling interests. On chilled and sand rolls the company is prepared to name prices for delivery after May 1.

The Falls Rivet & Machine Co. of Cuyahoga Falls, O., is reported to be installing machines for the manufacture of wire nails.

J. H. Williamson, business manager of the Viennot advertising agency, Philadelphia, announces the removal of his New York office from 127 Duane street to Room 719, Temple Court.

NATIONAL FOUNDERS' ASSOCIATION.

In reporting the proceedings of the National Founders' Association convention at New York in November, we presented a portrait of the new president of the Association, H. W. Hoyt, of the Gates Iron Works, Chicago. We take pleasure in giving in this issue portraits of two gentlemen who have been among the active spirits of the Association, particularly

ANTONIO C. PESSANO, VICE-PRESIDENT.

in the important events of the past 12 months. Mr. Ressano's efforts in a conference between foundrymen and molders at Cincinnati last year were instrumental in averting what might have been a serious clash. Mr. Russel, as a member of the administrative council, has had part in many important conferences between representatives of the two organizations.

Antonio C. Pessano is vice-president and general manager of the Geo. V. Cresson Co., of Philadelphia, whose foundries and machine shops are among the largest and best equipped in the country in their line of manufacture. Mr. Pessano had thorough preparation in machine construction and foundry practice, gaining a practical knowledge of both machinery and foundry trades in working for seven years in the shops of a large manufacturing concern. His training in technical engineering was obtained from the courses of the Franklin Institute, of Philadelphia. Among his instructors were Profs. Houston and Thomson, the well known electrical engineers; Prof. Kern, in mechanical drawing; and Prof. Bartine in mathematics. Though yet a young man—born in 1857—Mr. Pessano has made many improvements in power transmission, a score of patents having been issued to him, and many of the largest power plants in the country have been built after his designs and under his direction. He has been identified with all the movements looking to the improvement of practice in mechanical lines and designed to forward the interests of manufacturers. He has been an active member of the American Society of Mechanical Engineers, is chairman of the executive committee of the Foundrymen's Association, of Philadelphia, and a member of the Manufacturers Club, of Philadelphia. He was chairman of the third district committee of the National Founders' Association until November, when he was elected vice-president, succeeding H. W. Hoyt.

John R. Russel, of Detroit, who was elected treasurer of the National Founders' Association at the Detroit meeting in February, 1900, and re-elected at the New York convention, is secretary of the Russel Wheel & Foundry Co., of Detroit. He has been from the beginning an alert and able supporter of the movement for organization among foundrymen, both for the improvement of practice and the handling of labor troubles. Born in Detroit in 1857, Mr. Russel took a college course at the University of Michigan, Ann Arbor, Mich., and also received there the degree of medicine, having planned originally to follow that profession. Before completing the course, however, he had decided on a business and manufacturing career, and immediately upon graduation started as molder's helper in the works of his brothers, who had shortly before that time organized the Russel Wheel and Foundry Co., to do structural work, build industrial railways, logging cars and car trucks. Mr. Russel has been secretary and treasurer of the company a number of years, and since the retirement of the president from active management in 1896 to become president of a Detroit bank, the business has been in the hands of W. S. Russel, vice-president and manager, and John R. Russel.

American Competition for British Coal.

The reliable London correspondent of the *Glasgow Herald* learns that the representative of a large American firm whose connection with coal comprises the ownership of mines, railways and docks, is now in this country with the intention, when the subsidy bill is passed into law, of chartering or purchasing vessels, for the conveyance of large quantities of anthracite to this and other European countries. He further hears that this firm does not expect to have to contend for long only with the present high values of British fuel, but when any decided decline sets in will meet the difficulty by differentiating rates to home and foreign consumers. This is no new phase of American competition, although comparatively new to the coal trade. The iron and steel trades of this country have suffered severely from this cause, and one branch, the manufacture of tinplate bars, has been almost crippled. On the other hand, American trade circles have recently shown much discontent at being called upon to pay higher rates for American steel plates and rails than the same articles were at the time fetching on the Clyde. According to American principles of commercial economy this somewhat anomalous system of traffic is justified on the ground that makers have always a certain amount of surplus material, which it is more profitable to sell abroad, even at a loss, than to allow it to remain and clog the markets at home. Beyond this there is America's pressing need of all the ready money she can secure to finance her vast and growing industrial enterprises. Whether this policy is beneficial in its bearing upon the commercial welfare of the United States is a debatable point, but it has without doubt operated to the detriment of Great Britain's metal industries. That our coal-owners will suffer to the same degree is improbable. Coal, perhaps fortunately

JOHN R. RUSSEL, TREASURER.

for us, does not afford so great a scope for the ingenuity of American inventors, and, with due regard to the exigencies of progress, those responsible for our coal supremacy should never allow their competitors to lead in the race.—[London Colliery Guardian.

J. C. O'Donnell, of Pittsburg, has been appointed superintendent of the National Steel Co.'s furnace at Niles, O.

DEVELOPMENT OF THE GAS ENGINE.

G. Liekfeld, C. E., of Hanover, Germany, has written an article for the *Boiler Maker and Sheet Metal Worker* on "The Development of the Gas Engine and Its Influence on Our Provision for Motive Power." We make the following extracts:

Until about ten years ago gas motors were generally built according to N. A. Otto's model, known as gas motor compressors. Although Mr. Otto had to thank his great success, first of all, to the adoption of the plan of first compressing the mixture of gases, for a long time no sign was to be noticed of continuing this principle. Inventors seemed to be so well satisfied with the success attained by Otto, who had reduced the consumption of motor gas from three cubic meters to .08, that it was not worth the trouble improving the machine any further. Only after the expiration of the Otto patents, towards the end of the 80's, a stir was made. Free competition asserted itself, and it was not long before we received the announcement that the economy of the old Otto motor had been surpassed.

Further increase of compression, heightening of the dead center, the laying aside of the power-losing distributing slider, were the fundamental and most simple means by which the present standpoint was reached, so that today 0.38 cubic meter of illuminating gas, or 380 grammes of coke, with use of power gas are sufficient with medium-sized motors for the production of one horse-power. These are results distancing the economy of the largest and best executed steam engines considerably. If you add to this the small need of delay, the immediate effect of driving, the absence of danger, and the small space needed for gas motors, it can be denied no longer that the days of the steam engine are numbered, and that we have to look upon the gas motor as the one of the future.

Early Hostility of Engine Builders.

That the transit from the old to the new motor can only be accomolished gradually is evident. Those engineers and technical men who today occupy leading positions belong to a generation which received its education at a time when the steam engine was considered as the only reliable heat-power engine, and these men are not to be expected, in their responsible positions, to employ or recommend machines in which they have no confidence. But totally apart from these conditions the move of development assumed by the constructors of gas motors has not been favorable to their introduction. The gas motor assumed vitality at the time when diligent search was made for a suitable motor for small industries. The hot-air engine, on which such great hopes had been placed, had not stood in practice. No wonder then that the newly created gas motor, which possessed so many good qualities for small industries, was looked upon at first exclusively as a small motor, and was constructed thus; and factories which took up the construction, were only equipped for producing small machines. The actual steam engine works refrained totally from entering into the manufacture of the new machine. They looked upon it as an unwelcome intruder, that must be discouraged at any cost.

As a small motor they first came into the hands of people who had not the least conception of engines and their object, and under such conditions they often failed to do the work during the earlier years of their use. The introducers had to fight against many difficulties, and it took considerable time before the machines had been at all generally adapted and confidence in them inspired.

Introduction of Large Gas Engines.

All these conditions were, therefore, unfavorable to the development and application of the gas motor as a motive power on a large scale. Only with the introduction of apparatus for creating power gas by the Englishman, Emerson Dawson, about the middle of the 80's, did new life enter the construction of gas motors. As the motor was separated from the existence of the central illuminating gas plants there was nothing further opposed to its competing with the steam engine. There was no further interference now with the expensive illuminating gas, as with the apparatus for producing power gas, a gas could be produced containing over 80 per cent of the theoretical value of fuel heat in the gas, and the point was soon reached that the driving of a large gas motor with power gas was considerably cheaper than in the same size steam engine. The power gas apparatus proved to be extremely simple, reliable, and easily worked. The fuels used, anthracite or coke, were to be had everywhere. The confidence in the new motor increased enormously, and the gas motor works, on account of the small number which had been provided with, arrangements for the construction of large motors could not begin to keep pace with orders they are receiving.

If we cast a glance at the transformation which the small gas motor had to undergo so as to serve the purpose of large motive power, the first demand was that, like the steam engine, it should start of its own accord, thereby doing away with setting it in motion by hand, which was a necessity until then. The arrangements which were invented for this purpose have stood the test well in practice. We find, however, compressed air used mostly for this purpose. One or two propulsions with compressed air given to the piston, from which the gas is excluded, are enough for starting the motor. Where electric plants are driven and accumulation batteries are present, the dynamo, fed by the battery, is allowed to run as an electric motor, and thus starts the gas motor.

The continuation, which was generally effected in small motors with fusion of glow tubes, has been replaced by magnetic electric spark apparatus for large gas motors, and the latter has proved to be an excellent substitute. With the use of this apparatus it is possible to make the moment of combustion correspond exactly with the velocity of rotation. Immediately after starting, when the motor is slowly revolving, the combustion must take place considerably sooner than when the velocity of rotation is normal. This transfer of the moment of spark formation can take place most conveniently in the apparatus during the running of same. Also regarding the uniformity of motion in large motors, larger demands were necessary than was the case with small motors. The one cylinder motor, working on the principle of "four-impulse," had to be made in such a way that the uniformity of its motion was sufficient for dynamos of all kinds. Through further construction in the regulation of motors, with varying charges, through energetic regulators and heavy fly-wheels, these demands have also been satisfied.

Finally, it was also necessary to give more attention to the cooling of the valves of large motors, as also to the oiling of the pistons, and to the lubrication of the heavily loaded crank shafts, than formerly. In large motors, not only the valve housings are cooled, but also the hollow finished valve spindles. The lubricating oil for the pistons is not allowed to drop freely on the piston any more, but it is pressed, similar to steam engines, by means of small pumps, between the piston and cylinder surfaces. In well-finished motors the crank shaft is provided with ring lubrication.

By these and other improvements running safety and stability have been given to large gas motors, so that in this respect as well they can stand comparison with steam engines. The electric works of a place in the vicinity of the city of Hanover which for the past three years have been using two gas motors, each of 70 horse-power, have attained such good results with these motors that in the enlargement of the works a new 160 horse-power gas motor is being erected.

Reducing the Cost.

Let us now look toward the future development of gas motors and make conjectures in what manner the new motor is going to affect our provision of motive power. As an existing drawback to the rapid expansion of large gas motors, it must be said that today a gas motor with power gas plant costs as much as a steam engine with boiler of the same strength. The cause of this surprising fact—certainly so to the uninitiated—is to be found first of all in the principle of construction of gas motors—the so-called principle of "four-impulse." As one and the same piston is used for bringing and compressing the charge for taking up the power and expelling the combustion products, which gives this engine the name of "four-impulse" motor, it naturally follows that only the fourth part of the piston movements is effective, therefore all the revolutions of the machine are only used to the extent of one-fourth.

If each revolution were productive of power, theoretically, then, four times as much power would have to be produced with the same working cylinder. For this reason gas-motor constructors have, up to the present time, directed their efforts

to replace the "four-impulse" motors with those of one impulse. Although it cannot be said that the "one-impulse" motors (of which there have been several constructed in Germany as large as 500 horse-power) are equal to those of "four-impulse" in respect to safe running, nevertheless reliable firms are working further and energetically on their perfection. It goes without saying that it cannot be thought of constructing "one-impulse" motors at one-quarter the cost of the equally strong "four-impulse" machines, but it can be certainly accepted that the cost of production of gas motors will be considerably lowered in the future. Thus a new stage has been reached in the development of gas motors.

As soon as there are good gas motors, of which the first cost is perceptibly lower than that of the steam engine, the utility of the latter will be enormously diminished. Even where the employment of gas, petroleum and benzine motors appears quite barred out, *e. g.*, on large steamship engines, means and ways will soon be found for introducing them. The former inability to reverse, which has prevented gas motors from being applied to steamers, has been set aside by the introduction of the "one-impulse." The latest patent returns show that leading constructors of gas motors are giving considerable attention to the reversibility of their engines, and are busily engaged at same.

Utilizing Waste Gases.

While industriously working at the perfection of gas motors the fuel belonging to same has also claimed attention. Particular observation has been made of the waste gases in smelting and chemical works, and they have been tested for use in the running of gas motors. Waste gases of blast furnaces, coke furnaces and brown coal smelting furnaces were particularly noticed.

Through experiments made in this respect a few years ago, it was found, for instance, that gases coming out of blast furnaces, when used for producing power in gas motors, gave more than six times as much power as when they were consumed in the old way under the steam boiler for producing steam. A one-cylinder, 200 horse-power, 4-impulse motor, which amounted, with blast furnace gases, to 950 cal per cubic meter of heat, only needed three cubic meters per hour of these gases for each horse-power. At a brown coal mine with smelting furnaces, in which the escaping gases contained a heat of an average of 2,750 cal. per cubic meter, splendid results were also obtained by using gas in gas motors. Whereas formerly gases were allowed to escape in a large measure without using them, three gas motors of a total of 450 horse-power are now being driven by same, and through a very far-reaching electric plant almost the entire power and illumination required is furnished, not only for the works themselves, but also for the brown coal mines in the vicinity.

If the value of the blast furnace gases alone is kept in view, power sources are produced of which the force can hardly be estimated without investigation. The blast furnaces can not only cover the entire motive power required by them with same, but they will have a large quantity of this power at their disposal for other purposes, and which can be utilized elsewhere. Power capacity will therefore increase enormously in the near future. Electricity offers us the means of conducting large quantities of energetic force to great distances without serious losses, and there is no question but what industrial enterprises will be established in large numbers in the larger vicinities of iron smelting and coal districts, which can make use of the cheap and convenient means of obtaining power or light.

But in the cities as well, the conditions for providing power will change. The electric light plants which were built to furnish light to municipalities will have to be changed so as to drive their dynamos with gas motors. This will cheapen and simplify their running so considerably that electric power will be reduced to a price which will allow the running of industrial plants with electric motors on the most extensive scale.

The small motors made hitherto will disappear more and more, as is plainly noticed today, and the rising generation will see nothing new in power being furnished us the same as water or illuminating gas is now.

Plans for making Chicago a greater manufacturing center were taken up last week by the industrial location committee of the Chicago Real Estate Board. Chairman R. E. Iamond reported that information being sought regarding sites, transportation facilities, building materials, and other matters of importance to big firms or corporations, foreign and domestic, that might wish to establish plants in Chicago or its vicinity was coming to hand for the making up of the first pamphlet of statistics. The committee will have its permanent quarters at the board rooms, and all communications should be addressed to the "Industrial Location Committee of the Chicago Real Estate Board, 57 Dearborn street." The committee will push the work of compiling information of interest to manufacturers and circulating it.

British Blast Furnace Situation.

In presenting statistics of the blast furnace situation in England, Scotland and Wales at the close of 1900, the London *Iron and Coal Trades Review* says:

"The number of furnaces in blast at the end of the year was 356, which is 52 less than the number in blast at the beginning of 1900, 37 less than the number in blast at the end of the September quarter, and 49 less than the number in blast at the end of June last. We cannot say what the exact output per furnace has been for the year that has just ended, but it is likely to have been materially more than that of 1899, because in a number of cases furnaces were driven to their utmost capacity, and many furnaces had been better equipped for a large output during the two preceding years. But even if the average annual output for 1900 was only 26,000 tons per furnace, it would follow that the rate of production of the furnaces now blowing is about 1,350,000 tons a year, or 26,730 tons per week less than the furnaces in blast at this time last year. In other words, we have, since the beginning of 1900, reduced our pig-iron output by about 14 per cent. This result is, of course, mainly due to the high prices still quoted for raw materials. It is true that there have been substantial reductions in the price of coke, in some cases amounting to 9s. and 10s. per ton, and imported ores have fallen by 3s. to 4s. per ton, but both are still much too high to enable pig-iron to be profitably produced at a time when iron and steel values are coming down with a rush, and the pig-iron makers have adopted by far the wisest course in laying off a certain number of furnaces, the more so that they can utilize the occasion of so doing to relieve those that have been blowing during the boom. This will tend to bring the prices of raw materials down more readily and surely than any other course. At the same time, the pig-iron makers are evidently looking forward to doing well again in the future, for at the end of 1900 no less than 63 blast furnaces were being rebuilt or relined, which is almost a record number, and 20 more than the corresponding number of nine months ago. Hence it would appear that the resources for an increase of production are at the present time being considered increased."

The board of directors of the Pennsylvania Steel Co. last week adopted the $50,000,000 reorganization plan. Notices will be sent to the stockholders asking them to deposit their stock in assent to the plan, not later than April 1. If by that time practically unanimous consent is not obtained the plan will be abandoned. The new company is to have an authorized capital of $25,000,000 preferred stock and $25,000,000 common stock, of which $4,500,000 preferred and $10,250,000 common will remain in the company's treasury. The business has increased from $6,873,590.75 in 1896 to $19,693,848.79 in 1900. The bonded debt on both the Steelton, Pa., and the Sparrows Point, Md., plants is $6,500,000 and the share capital is $6,500,000, or $13,000,000 in all. The actual present value of the plants, the president's statement says, is in excess of $20,000,000. The profits of the past two years have been large, and except a small sum paid in dividends upon preferred stock, remains in the business. The company has sufficient orders to keep some departments running the entire year.

Reginald Fessenden, secretary of the Engineers' Society of Western Pennsylvania of Pittsburg, is meeting with success with his experiments with wireless telegraphy. He is in the employ of the government at present and it is stated that he has made a number of inventions that are of more value than those previously made in the development of the new art.

ELECTRICITY IN AN ENGLISH STEEL WORKS.

As illustrating the more recent uses of the electric motor in the driving of machinery several important installations of direct and alternating current apparatus in the steel and iron works of this country and England are worthy of note. There are few classes of work in which until lately British custom has followed more closely the lines of tradition than the manufacture of steel. But within the last few years modern methods of electric driving have taken quite a prominent place in English steel work practice.

The accompanying illustrations give a good idea of the installation of electric apparatus at the Parkgate Steel Works. This large plant, located in the vicinity of Sheffield, Eng., has been fitted recently with Westinghouse steam and electric apparatus. In a brick power house, at a distance from the mills, are installed two Westinghouse compound steam engines, each connected direct to a Westinghouse 250-k. w. engine type generator. This power plant provides a surplus output sufficient to take care of a considerable increase in the works, and room has been left in the power house for a third generating set of capacity equal to one of the existing units. At present one generating set is sufficient to provide for practically the entire plant; and when the proposed additions are made to the property two units will operate all the machinery, while the third is held in reserve. Current

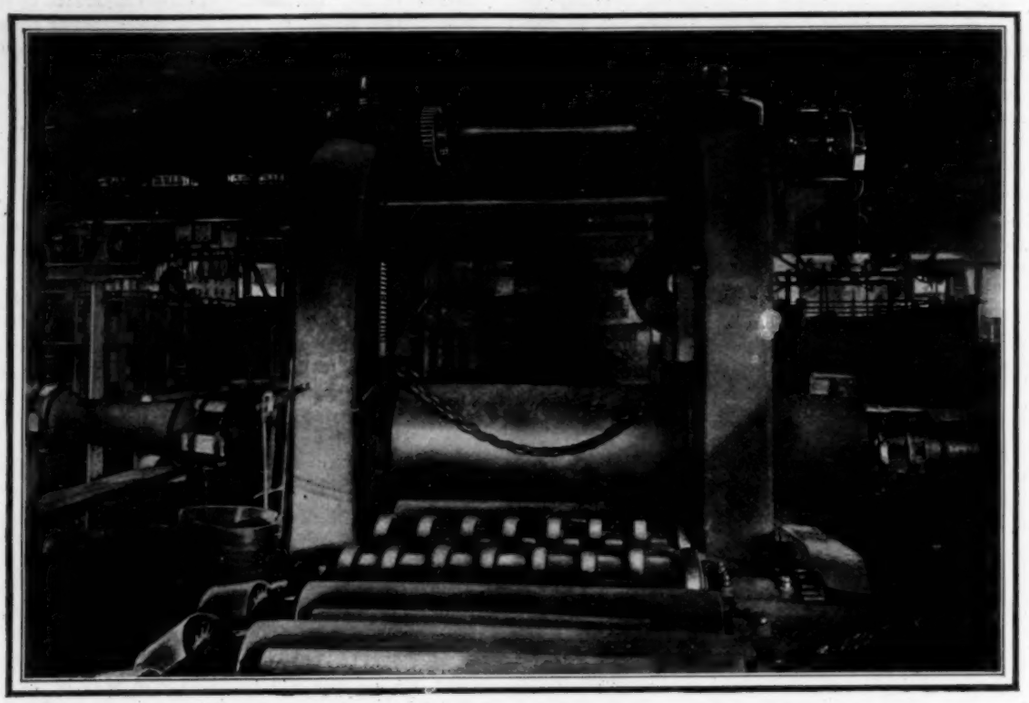


FIG. 1.—WESTINGHOUSE DIRECT CURRENT MULTIPOLAR MOTOR OPERATING ROLLS AT THE PARKGATE STEEL WORKS, SHEFFIELD, ENG.

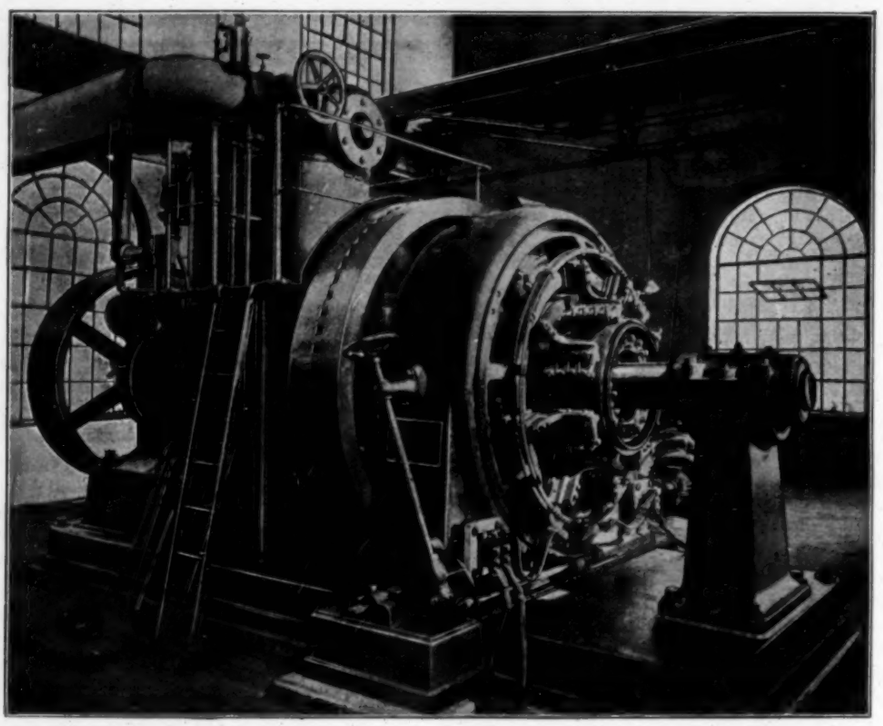


FIG. 2.—WESTINGHOUSE DIRECT CURRENT GENERATOR, ENGINE TYPE, DIRECT CONNECTED TO A WESTINGHOUSE STEAM ENGINE AT THE PARKGATE STEEL WORKS.

from these generators is supplied to the cogging mill, the plate mill and the mechanism of the melting furnaces. It is conveyed on bare copper cables secured to petticoat porcelain insulators. The works are also lighted from the same source.

Brief mention may be made of the applications of the electric motor at this plant. A 15-h. p. Westinghouse dust proof motor is in use, driving the pug mill; and the four open-hearth furnaces are also fed by means of Wellmann chargers which are run by electric motors. Fig. 3 shows the Wellmann charging machine—the familiar car operating on a broad gauge track, supporting a superstructure of steel, which extends to the furnace doors. Each charger requires four motors, all of which are operated by one attendant.

The motors used for the pug mill and the charging machines work under the most severe conditions. In the vicinity of the pug mill the air is loaded with metallic dust which would be ruinous to a motor the windings of which were exposed to the air. It is particularly for work of this character that the Westinghouse dust proof motor was designed. The conditions found on the charging machines are equally severe, for here the heat is so intense that exposed windings would be in danger of continual breakdowns. Accordingly the motors are covered over entirely with steel casings, in addition to which the coils of the fields and armatures have been especially designed for such hard service. The electric motor as thus applied has been found to have a great value in determining the output of the open-hearth furnace, because by means of the electrically driven chargers nearly all of the time ordinarily consumed by cruder methods of charging is saved. Accordingly the output of the furnace is increased by about 30 per cent; at the same time the expense of running it is materially reduced.

The motors used in the operation of the cogging and slabbing mills are designed for very heavy overloads. They are placed below the floor level, are therefore out of the way, and require almost no attention. The live rollers are driven by 30-h. p. motors and 15-h. p. motors are used for lifting the rolls. These motors are installed on top of the roll housings. After leaving the rollers the slabs are cut by electrically operated shears. The hot saw used on billets up to six inches in diameter is also driven by a large electric motor. The live rollers of the main 36-inch plate mill are driven by 30-h. p. motors, the three sets of housing requiring in all six motors. Lifting, lowering and skid gear are run by motors of smaller size. This mill is also served by electric cranes.

In addition to operating the main portion of the steel plant, small motors are used for driving the various machine tools, such as are found in the auxiliary equipment of works of this character. Conspicuous among these minor uses is a stone-breaker electrically operated. In addition good brick clay has been found on the property and a brick making plant has been put up, operated by electric motors.

Not the least important result of the substitution of electric for other systems of driving is the improvement in the working conditions of the plant. The mill being free from piping, shafting and belting, is cleaner and has better illumination than is found in the case of mechanical driving, and the electric equipment is operated more conveniently and with less labor than in the case of steam driving. Later we shall give some details of similar plants in this country, which the Westinghouse Electric & Mfg. Co. have equipped with electrical apparatus.

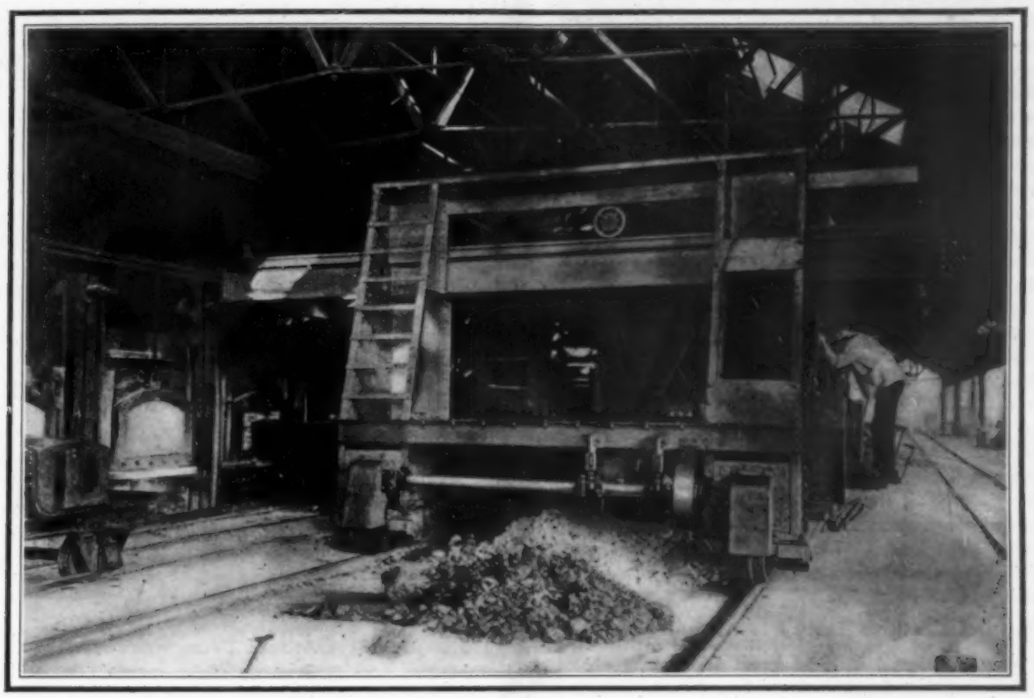


FIG 3.—WELLMAN FURNACE CHARGING MACHINE, OPERATED BY WESTINGHOUSE DUST PROOF MOTORS.

Nickel Industries of Canada.

Nickel was first found to exist in paying quantities in Canada in the year 1887, the principal deposits being in the Sudbury district. Since then the industry has developed until it is claimed that Canada furnishes over 40 per cent of the nickel of the world. The district in which the ore is found is near Sudbury, in Ontario, and is about 70 miles long by 40 miles wide. It is estimated that there is enough nickel now located to supply the world for the next hundred years at the present rate of consumption. There are now less than a dozen mines equipped with plants, with an output of about 700 tons of ore per day. The deepest mine goes down about 1,000 feet, and others from 50 to 400 feet. The principal companies operating and preparing to operate in this district on a large scale are the Canadian Copper Co., of Cleveland; The Mond Nickel Co., of London, Eng., and the Lake Superior Power Co., of Sault Ste. Marie.

The employees of the Crane Co., Chicago, in view of the good relations existing between themselves and the company, presented president R. T. Crane with a set of resolutions last week, thanking him for the many kindnesses extended by the company to the employees. Mention is made of the voluntary increase of 10 per cent given by the company in May, 1898, and the recent Christmas distribution of a share in profits made to the various departments. The resolutions express the deep regard the employees have for Mr. Crane, for his endeavors to promote their welfare in every way possible.

GREAT RESOURCES OF "THIS COUNTRY OF OURS."*

BY JOHN BIRKINBINE.

The title "This Country of Ours," appears upon the book-cover of an admirable presentation of "The Machinery of Our National Government in Motion and Some Instruction as to the Relation and Use of the Several Parts." In the preface the author, ex-President Harrison, announces that the "volume does not deal at all with the material resources of our country," but that its purpose is "to give a better knowledge of things that have been too near and familiar to be well known. We stumble over things that are too near our toes." This is equally true of our material resources, which are far from receiving the appreciation they deserve. The limitations of an evening are far from sufficient to even touch on the big things in and of this big country; the difficulty being to select illustrations and data which will invite attention to a few prominent features of topography or instances of development, leaving each one to fill in the details from personal knowledge. Our *resume* must be restricted to what we may (in the light of recent events)designate the "Old United States"; for if we included even Alaska, with its many attractions, and omit reference to Porto Rico, the Hawaiian Islands, and the almost unknown Philippines, subjects nearer home must be omitted. There are glories enough in that part of the Continent of North America which lies between the Dominion of Canada and the Gulf and Republic of Mexico, bounded on the east by the Atlantic Ocean, and on the west by the Pacific Ocean, covering an area of 3,025,600 square miles, of which 55,600 square miles is water surface. No one can even summarize all the big things of this great country within the bounds of the patience of an audience, and there is no exaggeration in the statement that a thousand selected lantern slides would fail to illustrate fully the really notable physical features or instances of material progress in the old United States. Mr. Andrew Carnegie truly asserted that this country of ours is "the richest nation in the world, the most prosperous, the greatest manufacturing nation (home and foreign combined), the best educated people, the highest-paid labor—in all these respects the foremost nation on the earth." Our population of 76,000,000, it may be conceded, is cosmopolitan too, for our foreign population, about 10,000,000, is augmented by an average annual immigration of about one-third million, representing more than ninety nationalities. Nearly all the nations of the earth contribute; many by entire communities, most of them by multitudes scattered throughout the land. With one-twentieth of the population of the world, we are credited with over one-fifth of the entire wealth of the human race.

Natural Features Turned to Account.

This territory mentioned includes great lakes, magnificent rivers, grand mountains, fertile valleys, boundless plains, extensive deserts, marvelous water-falls and rapids, superb forests, varied topography and climate, and unlimited stores of minerals—all given us by the Creator. Our people have constructed vessels and improved the navigation of the lakes, rivers and harbors, built roads across plains and streams, and over or through the mountains; cultivated the plains and valleys; reclaimed deserts; established towns and cities; harnessed some water-falls for service; used much, but wasted more, of the forests' products; won from mother earth enormous stores of mineral wealth; raised animal and vegetable food; material for clothing, etc., for ourselves as well as for other nations, and developed industries and manufactures at a rate unequalled elsewhere. Besides providing for the wants of ourselves, statistics show that during the year ending June 30, 1900, our exports averaged over $4,000,000 in value for each working day—one-fourth of this being manufactured goods.

We have numerous volcanic mountains; enormous lava-covered areas; wonderful glaciers and noted instances of glacial action; world-famed geysers; our rocks show all the geological ages; our minerals and mineral products include practically all that are found elsewhere; our fruits and crops embrace, with few exceptions, all of those indigenous to other nations. Perennial summer reigns in the extreme South, while our northern boundaries are ice-bound for one-third of the year. With no desire to criticise those who seek variety in scenery or customs or evidences of material development, by visiting other countries, there are in our own land impressive instances of almost every feature which attracts the tourist to cross the ocean in search of variety.

Some of our big things have proven great trouble, for unfortunately it is not necessary to go beyond our boundaries for evidences of remarkable disasters. The Philippines and Eastern Asia suffer from earthquakes; so has our Pacific coast, and the disaster of which Charleston, S. C., was the center is still fresh in memory. China has a terrible flood record, but our own periodic overflow of the Mississippi and its tributaries and the record of freshets throughout the country, show that we have similar visitations. The destruction of Johnstown illustrated in an awful manner the destructive power of water. Nor need we go to the West Indies for cyclones or tornadoes, for those at Galveston or St. Louis or nearer home, have left indelible marks of what wind storms can do. We have our great fires when towns such as Hinckley, Peshtigo or Cripple Creek, and even the city of Chicago, practically disappeared in a few hours, licked up by devouring flames.

We have historic battle-fields made sacred by American blood shed in our early Indian wars and the struggle for independence, and in our internal strife culminating in Gettysburg, which demonstrated that the American Union could be maintained as a government of the people, for the people, by the people.

Facts About Topography.

The topography of the United States ranges from 270 feet below to 15,000 feet above sea level. On some portions rain seldom falls; at others rain is deposited on nearly every day of the year. On August 3, 1898, more rain fell in Philadelphia in one and three-fourth hours (5.43 inches) than is precipitated in a whole year in some portions of the United States. It is estimated that in this one and three-fourths hours 1,500,000,000 cubic feet of water, equalling 42,000,000 gross tons, fell upon the area of Philadelphia.

Do you realize that Chicago and other lake cities, also Pittsburg, are about the elevation of William Penn's hat on the Philadelphia public buildings above sea level? That in crossing the great plains of Nebraska, speeding along on an apparently level prairie, you are higher than the crests in the Allegheny Mountains in Pennsylvania? That Salt Lake, our Dead Sea, is 4,200 feet above ocean level? That many of the peaks in the Rocky Mountains and Sierra Ranges are over 14,000 feet high? Or that the mountains in western North Carolina are from two to three times as high as our Alleghenies in this State?

The waters of the Atlantic Ocean which lave the shores of Europe also beat against our coast line of 1,800 miles from the rocky islands of Maine to the Florida Keys. The Pacific Ocean is in part ours, for its breakers roll on our western coast from Cape Flattery at the Straits of San Juan de Fuca 1,200 miles to San Diego, in Southern California, and if we add the Alaskan coast line, to double that distance. The warm waters of the Gulf of Mexico extend for 1,000 miles on our southern boundary, and part of our northern boundary consists of a chain of lakes upon which vessels may sail for 1,300 miles.

Commercial Significance of the Great Lakes.

The traffic of the Great Lakes has grown with marvelous strides, but its magnitude is scarcely appreciated, although the statement is made that a larger tonnage passes Detroit, Mich., between the upper and the lower lakes, than at any other point on this earth. While below this immense traffic railroad trains pass through a tunnel laid under the St. Clair River, connecting the tracks in the United States and Canada. Just what this lake traffic amounted to in 1900 cannot now be given in exact figures, but it probably exceeded 40,000,000 tons. Fortunately, the reports issued by the superintendent of the canals at Sault Ste. Marie, Michigan and Ontario, aid us in this estimate. The commerce which passed through them in the 231 days during navigation in the year 1899 is represented by 20,255 vessels, carrying over 25,000,000 tons of freight, of which over 15,000,000 tons was iron ore, and 4,000,000 tons was coal. One-fourth million tons was pig iron and

*Extracts from a paper presented in connection with lantern slides at a meeting of the Manufacturers' Club of Philadelphia.

manufactured iron, 120,000 tons metallic copper. In addition the traffic included over 58,000,000 bushels of wheat, 30,000,000 bushels of other grain, over 7,000,000 barrels of flour, over 300,000 barrels of salt and 1,038,000,000 feet board measure of lumber. Eighty-one per cent of the vessels and 86 per cent of the above tonnage passed through the American locks, the balance going through the canal on the Canadian side.

The average cost of carrying one ton of freight on the lakes approximates eight-tenths of one mill per mile, and coal has been transported 900 miles for 20 cents per ton. This is due to the economical methods of loading and discharging vessels, the increased size and power of the ships employed and the character of the freight.

One-Third of the World's Railroad Mileage.

We annually transport within the area of the United States more freight than all other countries combined. Within this area is over one-third of the railroad and one-half of the telegraph mileage of the world. The advance in railroad transportation may be best epitomized in the statement that freight rates which 30 years ago averaged two cents per ton mile now average about three-fourths cent per mile. In the construction of locomotives to haul cars over these roads we have made marvelous development; 2,452 were built in 1899, and the handiwork of Philadelphia mechanics is seen in all parts of this country, and in fact all over the world. Even the few specially industrial countries have been invaded. Over 118,000 railroad cars were constructed in 1899.

Throughout the nation there are magnificent evidences of the skill of American engineers and American mechanics in bridge construction, and they are so numerous as to make selection for illustration difficult. The Pecos Viaduct in Texas, made by the Phoenix Iron Co., is 326 feet high, 2,180 feet long; the Brooklyn Bridge, the second longest span in the world; the new bridge just built at Niagara Falls, the longest single-arch span in existence. The length between centers of skewback pins is 840 feet, and the rise of the arch is 150 feet. The bridge floor is 190 feet above the water in the Niagara River, and 1,240 feet long. The total weight of metal is 4,500,000 pounds. The St. Louis bridge was the first steel bridge constructed, our Chestnut street bridge the largest cast-iron bridge.

Attention can only be directed to the numerous marvels in engineering construction which have carried railroads over or through mountains, along precipitous walls of canyons and gorges, or to the many instances where great works have been carried out for public water supply or drainage. The Chicago drainage canal may be instanced as suggestive.

Our public buildings, while as a rule less pretentious than those of other nations, are in many instances noteworthy, and at least rival European structures in cost. Our railroad stations, industrial works, do not suffer by comparison with those elsewhere, and we are in the van with office structures. If we except the Cliff Dwellings as instances of antiquity, we have comparatively few structures hoary with age. But there are numerous buildings which for historical interest or for what has been accomplished within their walls are venerated and considered old for a young country.

Mining and Allied Industries.

We may properly devote a few moments to our mining industry and its allied interests. In 1899 there were mined in the United States: 172,600,000 long tons bituminous coal, and 53,900,000 long tons anthracite coal; approximately one-third of the world's production. The total value of the coal mined was close to $256,000,000. These quantities indicate that every working day this country of ours produces 750,000 long tons of coal, representing trains aggregating 37,500 20-ton cars. Allowing 40 cars with caboose, engine and tender to a train, the total length of trains representing one day's shipping, standing end to end, would cover 234 miles of track.

In the year 1899 the production of pig iron in the United States was the largest annual output ever recorded by any country, the total being nearly 13,620,000 gross tons, valued at $245,000,000, and we mined for use in this industry, 24,683,173 long tons of iron ore, valued at the mines at $35,000,000. The figures for 1900 will exceed those of 1899.

The United States produce annually about 3,400,000 troy ounces of gold; 54,000,700 troy ounces of silver, valued at $70,800,000 (coining value). Converted into gross tons this country of ours contributed in 1899, 105 tons of gold, 1,715 tons of silver, 262,206 gross tons of copper.

The valuation of the copper mines in the Michigan peninsula exceeds $100,000,000. Fifteen mines have paid a total in dividends of nearly $100,000,000. One mine alone, thus far in 1900, has declared dividends of $5,000,000. In this peninsula are the deepest mines in the world; one vertical shaft having reached a depth of 4,900 feet, while several others are below the 4,000 foot level. Montana was credited in 1898, with adding to the country's wealth $5,000,000 of gold, $29,500,000 silver, $23,000,000 copper, and about three-fourth million dollars of lead. Two copper companies have paid dividends, thus far in 1900, of $6,000,000 each. This country exceeds a yearly product of 209,000 short tons of lead, valued at $18,800,000, and 119,000 short tons of zinc, valued at $13,700,000.

Petroleum has assumed a place in our regular routine of business, so that we fail to notice that three-fourths of a barrel is produced annually per inhabitant, or that 1,000,000 gallons of this natural product is delivered to Philadelphia daily through pipe lines over 300 miles long. Nor do we appreciate the fact that the natural gas utilized in the year 1899 represented a value of $20,000,000 and that nearly 40,000,000 gallons of domestic mineral waters were sold in 1899.

The salt industry has reached a product of over 18,000,000 barrels per annum, and aluminum, which a few years ago was practically a precious metal by reason of its cost, is now produced in the electric furnaces at the rate of 2,600 tons per annum and sold at about 33 cents per pound.

The total value of the mineral products of the United States in 1899 approximated one billion dollars.

None of our mountains are active volcanoes, but who can say that some of those snow-clad peaks which have in former ages contributed the great lava overflows in the western country may not add this feature to our natural wonders? Much of the territory covered by lava overflows appears unproductive because of the scarcity of rain, but the engineer has supplemented nature and by the construction of enormous dams and reservoirs to conserve the water and convey it by miles of expensive ditches and pipe lines across valleys, etc., to irrigate these apparently barren lands from which the most satisfactory crops are raised. Vegetables, fruits and trees abound in what formerly was a sage-brush desert. Upon the great plains we depend for much of our useful animal life. Herds of horses are raised and are watched over by those Western American specialists, the cowboys. Thousands of cattle are there pastured and prepared for consumption.

Harnessed Water Powers.

Our country is well supplied with rivers, on which are many waterfalls, either as rapids or cataracts; some of these are being harnessed to develop power for mining, manufacturing, illumination, transportation or industrial uses. At Niagara water wheels aggregating 75,000 horse power are now installed, and the two-power plants at the Falls are planned to ultimately operate machinery aggregating over 200,000 horse power. In addition there is a project for obtaining power from the whirlpool rapids in the gorge of the Niagara River. The Dalles of the St. Louis River in Minnesota, and the Whirlpool Rapids of the Niagara River, two attractive possibilities in water power development, are interesting as indicating the limitations now controlling the greater part of our lake traffic. Snoqualmie Falls, on the west flank of the coast range in Washington, higher than Niagara, but of moderate width, is being harnessed to supply power and light to Seattle and Tacoma, using for that purpose 150,000 pounds aluminum wire. Other notable developed or prospective water powers need not be instanced. Pennsylvania has no great fall like Niagara, but it is favored with many minor cataracts or rapids which add to its beauty and offer possibilities for utilization to advance its material wealth.

In this hurried review there is more left unsaid than has been presented. Each one can supplement the facts offered from his personal knowledge, for the effort has been merely to recall to notice some of the big things of this country of ours, of which we may justly be proud; not in a spirit of vaingloriousness but with a desire to inspire in ourselves a higher patriotism and a stronger appreciation of our responsibilities as a nation with a great destiny.

FINISHING RAILS AT LOW TEMPERATURE.

A correspondent of the *Railroad Gazette* signing himself "A B," writes as follows about the new arrangements at the Edgar Thomson rail mill recently described and illustrated in these columns:

"They have moved the finishing rolls ahead about 56 feet, and have a cooling bed about 100 feet long and 8 feet wide to hold the rails as they come from what is termed the 'short rolls.' The rails leave these rolls at a yellow heat (1,900 deg.) and are allowed to remain on this table for about 1 minute 15 seconds, until they come to an orange or about a free-scaling heat, somewhere about 1,500 deg., when they are put through the finishing rolls. During the afternoon that I was in the mill they never had more than four or five rails on the table at one time. This seemed to be plenty to allow the mill to be operated steadily and no time was lost waiting for rails to reach the proper temperature before giving the finishing pass. One thing seems certain to me, and that is that the rails are finished at a varying heat under the present method. While observing this rolling some of the rails were allowed to remain on the cooling table a little longer than usual, owing to the breaking of some machinery on the hot saw bed. Such delays, which must occasionally occur, will always tend to make the finishing heat vary. Their practice of keeping the rails on the cooling bed in such position as to allow the flange or one rail to be near the head of the following rail is all right, but in many cases the rails were not touching each other. The cooling is hardly fast enough to cause much distortion, but I do think that in many cases the flange will be found to be finished at a little lower temperature than the head.

"These rails finish up very clean and smooth, much better than when finished at a higher temperature. While I have had no chance to make a microscopic investigation of the fracture of the different rails the fractures obtained in making the ordinary drop tests show a hardened skin of varying depth which is noticeable to a trained eye. This is evidence that this method of rolling gives a rail with a much harder and better wearing surface than heretofore, and I think that further investigation and development along these lines will give a very serviceable rail. The method is thoroughly practicable and will be improved upon. My statements made regarding temperature in this letter depend upon my judgment of heat colors, and the information I could secure from men about the mill. The Carnegie people evidently took their temperature with a pyrometer.

Engineers' Society of Western Pennsylvania.

At the annual meeting of the Engineers' Society of Western Pennsylvania, held at the rooms of the society in Pittsburg, Tuesday evening, Jan. 15, the resignation of Reginald A. Fessenden as secretary was received and accepted. Mr. Fessenden is at present employed by the government making experiments with wireless telegraphy and according to all reports is making such a great success of his new undertaking that there is little probability of his returning to Pittsburg for some time. Officers were elected as follows: H. W. Fisher, president to succeed W. A. Bole; Prof. C. F. Phillips, vice president for a term of two years; directors, C. B. Connelly, J. M. Camp and Richard Hirsch. C. W. Ridinger was elected secretary to succeed Mr. Fessenden and A. E. Frost was re-elected treasurer. The following were admitted to membership: Horace S. Clark, engineer, with Westinghouse Air Brake Co., Wilmerding, Pa.; Alexander Coulter, superintendent, Salem Coal Co.; Barclay W. Everson, sales agent, Baldwin Locomotive Works, Philadelphia; James Smith Haring, civil engineer; Geo. Weymouth Hutchinson, mining engineer, with Coulter & Huff Interests, Greensburg, Pa.; Guy Roche Johnson, superintendent, blast furnaces of Duquesne Works, Carnegie Steel Co., Duquesne, Pa.; Thomas H. Jones, superintendent Jones & Laughlins' Soho mill, Pittsburg, Pa.; Jesse D. Lyons, merchant engineer, 401 Chronicle Telegraph Building, Pittsburg, Pa.; Eugene L. Messler, general superintendent Jones & Laughlins' Eliza Furnaces and Coke Ovens, Pittsburg, Pa.; J. Weidman Murray, resident manager, The Edward P. Allis Co.; Hugh McCulley, superintendent Jones & Laughlins' machine shop, Pittsburg, Pa.; Dana Stewart Rolfe, assistant to general manager Jones & Laughlins', Ltd., steel works department; R. I. Todd, Carnegie Steel Co., Duquesne, Pa.; Francis H. Treat, general superintendent, Jones & Laughlins', Ltd., Pittsburg; Samuel M. Kintner, professor electrical engineering, Western University of Pennsylvania, Allegheny; Thomas Steel Perkins, with Westinghouse Electric and Mfg. Co.; Richard Andrew L. Snyder, chief tester for C. D. & P. Tel. Co., Pittsburg; Herman L. Van Valkinburg, with Westinghouse Electric and Mfg. Co.

Connellsville Coke Trade in 1890.

The statistics of the Connellsville *Courier* show that the Connellsville region in 1890 marketed 10,166,234 tons of coke. An average price of $2.70 was received, making the total value at the ovens $27,448,832. The following table shows the total number of ovens at the close of each year, the annual output, average price and gross revenue of the region from 1880 to date:

Year.	Total Ovens.	Tons Shipped.	Av. Price.	Gross Revenue
1880	7,211	2,205,946	$1 79	$ 3,948,643
1881	8,208	2,639,002	1 63	4,301,573
1882	9,283	3,043,394	1 47	4,473,889
1883	10,176	3,552,402	1 14	4,049,738
1884	10,543	3,192,105	1 13	3,607,078
1885	10,471	3,096,012	1 22	3,777,134
1886	10,952	4,180,521	1 36	5,701,086
1887	11,923	4,146,989	1 79	7,437,669
1888	13,975	4,955,553	1 19	5,884,081
1889	14,458	5,930,428	1 34	7,974,663
1890	16,020	6,464,156	1 94	12,537,370
1891	17,204	4,760,665	1 87	8,903,454
1892	17,256	6,329,452	1 83	11,598,407
1893	17,513	4,805,623	1 49	7,141,031
1894	17,834	5,454,451	1 00	5,454,451
1895	17,947	8,244,438	1 23	10,140,658
1896	18,351	5,411,602	1 90	10,282,043
1897	18,628	6,915,052	1 65	11,409,835
1899	19,689	10,129,764	2 00	20,259,528
1899	19,629	10,129,764	2 00	20,259,528
1900	20,954	10,166,234	2 70	27,448,832

From the above table it is seen that though the outputs for 1899 and 1900 were practically equal, over $7,000,000 more was received for last year's output than for that of 1899. The value of the coke output of 1900 was double that for 1898, or any preceding year. Last year marked an exceedingly prosperous period for the Connellsville district.

The proposed issue of 50,000 shares of Dominion Iron & Steel Co. pfd. stock, will be offered to the public at $100 per share. The stock is 7 per cent cumulative and is subject to be called by the company at $115 per share, or may be exchanged for common stock at any time. With issue of this stock the capitalization of the Dominion Iron & Steel Co. will stand as follows: First mortgage 5 per cent bonds, $8,000,000; 7 per cent preferred stock, $5,000,000; common stock, $15,000,000. The new issue of preferred stock has been underwritten.

The report is again in circulation that the fire brick manufacturers on the Ohio river will combine. The effort has been made several times in the past three years. The plants which it is proposed to include are those at Ironton, Portsmouth, Sciotoville, Bellaire and Cincinnati, O., and Ashland and Olive Hill, Ky.

C. S. Trench & Co., of New York, in their statistics of pig tin stocks, dated Jan. 2, 1901, show that there was in stock in London, Holland and the United States or afloat on Jan. 1, 14,426 gross tons, against 16,334 tons Dec. 1, 14,211 tons Nov. 1, and 16,516 tons Oct. 1. The estimated consumption in the United States in December was 2,500 tons, making estimated stocks on spot, New York, Philadelphia and Boston on Jan. 1 1,351 tone, against 540 tons on Dec. 1. Adding actual amounts afloat from East Indies, England and Holland, gives total visible United States stocks, spot and afloat, Jan. 1, of 3,001 tons, against 3,327 tons on Nov. 1 and 4,460 tons on Oct. 1.

The annual meeting of the Monongahela River Consolidated Coal & Coke Co. was held at Pittsburg, Tuesday, Jan. 15. The report shows the company to be doing a profitable business. The old board of directors was re-elected as follows: J. B. Finley, H. C. Fownes, George I. Whitney, Samuel S. Brown, A. Jutte, William B. Rodgers, Hugh Moren, George W. Thies and O. A. Blackburn. J. B. Finley is president; George I. Whitney, treasurer, and George W. Thies, secretary. The company's investments represent $38,151,309. Undivided profits are $495,636. The preferred stock is $9,915,000; common stock, $20,000,000; bonds, $9,479,000.

LOW WATER ALARM AND BLOW-OFF VALVE.

The Crane low water alarm as originally made by the Crane Co. of Chicago, has been modified because of the law passed by some of the States stipulating that low water alarms should be of a type capable of being tested by the inspector of workshops and factories. It was necessary, therefore that an additional valve with pipe and fittings be used. The Crane patent low water alarm can be attached directly on top of the boiler or can be piped to any position most convenient to the engineer. Fusible gaskets are furnished, that melt at 270 degrees. The illustration shows how the device is attached. A hole is drilled and tapped in the top of the boiler, of the same size as the bushing A. A short piece of pipe is screwed inside the bushing, this being long enough to reach within two inches of the top boiler tubes. The tee E is connected by a pipe to any suitable place in the boiler producing live steam.

As long as the water does not go below the low water line, the water in the tube B prevents the steam from reaching the fusible plug. The moment the water falls below the low water line, the steam will rush in and fuse the plug C, thereby allowing the steam to escape through the hole in the wheel, which raises the lever D, opening the valve in the

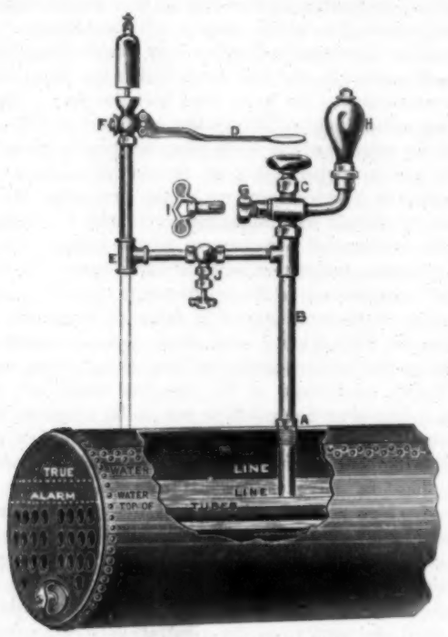


FIG 1.—CRANE PATENT LOW WATER ALARM.

whistle F, thereby allowing the steam in the pipe E to give the alarm. To renew the fusible plug, close the valve G, unscrew the nut C, and insert a new gasket. Then replace the nut C, allowing the pipe B to cool before opening the valve G. Then remove the key I, which indicates that valve G is open and ready for operation again.

The Crane Co. also manufactures the blow-off valve, shown in Fig. 2, which was designed to overcome the trouble generally experienced with the ordinary valves and cocks used for this purpose. The valve seat is on the outside, which prevents sediment lodging at this point. The projection on the under part of the disc prevents any discharge taking place until the seats have become widely separated. This prevents wire drawing. It is necessary that the valve should always be connected from the pressure side. They can be made in either angle or globe patterns, and the angle pattern is always furnished unless otherwise ordered.

The Bethlehem Steel Co., South Bethlehem, Pa., makes the following statement: "It has been brought to our attention that a concern styling itself the Edison-Holzer Steel & Iron Process Co. has been using the name of the Bethlehem Steel Co. in a letter issued by them in which they ask for subscriptions to the stock of their company. We beg to state that this Company has no connection whatever with the Edison-Holzer Steel & Iron Process Co., nor do we in any way endorse the merits claimed by them for their process for treating steel."

AMERICAN TIN PLATE CO.

At the annual meeting of the American Tin Plate Co. on Jan. 15, when a dividend of 8 per cent on the common stock was declared, as heretofore stated, George Greer, Cecil A. Robinson and Warner M. Leeds were elected directors for five years. William B. Leeds was made a director in place of W. D. Donner, who resigned. The following officers were elected: President, D. G. Reid; first vice-president, W. T. Graham; second vice-president, Warner Arms; third vice-president, William B. Leeds; treasurer, F. S. Wheeler; secretary and assistant treasurer, E. G. Applegate; assistant secretary and second assistant treasurer, H. B. Wheeler. The company earned $4,574,667 or 16 1-3 per cent on its common stock of $28,000,000 during its second year, after paying the dividend on the preferred stock and all other charges. After the annual stockholders' meeting, at which the statement of earnings was submitted, the directors charged off $1,500,000 for depreciation. Allowing for this reduction, earnings applicable to the common stock were equivalent to 10.9 per cent.

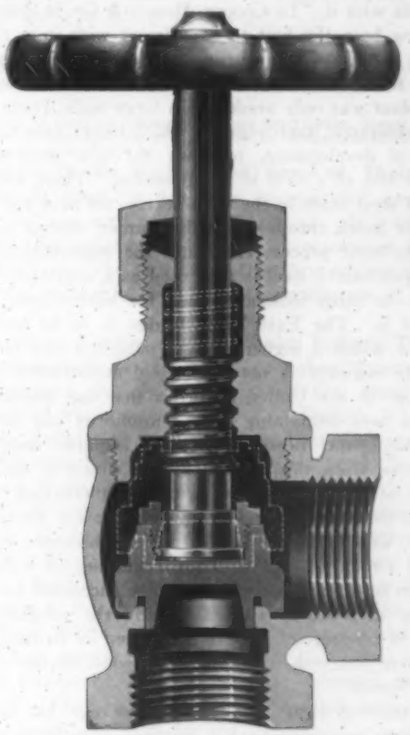


FIG. 2 —CRANE BLOW-OFF VALVE.

The balance sheet as of Dec. 31, with a comparison with the preceding year, is as follows:

ASSETS.	1900.	1899.	Increase.
Plants, patents, etc	$43,494 161	$43,404,508	$ 89,653
Securities purchased in year	1,127,801	.....	1,127,801
Other securities	375,000	.....	375,000
Merchandise	4,851 544	4,951,946	°100,382
Accounts receivable	1,468,193	1,518,247	°50,054
Cash	3,367,246	989,983	2,377,262
Tota's	$54,683 945	$50,864,665	$3,819,280
LIABILITIES.			
Preferred stock	$18,325,000	$18,325,000	.....
Common stock	28,000,000	28,000,000	.....
Totals	$46,325,000	$46,325,000	.....
Purchase money mortgage	195,000	270,000	°75,000
Accounts payable	948,424	1,656,239	°707,815
Surplus	7,215,521	4,613,426	4,602,095
Totals	$54,683,945	$50,864,065	$3,819,280

°Decrease.

Net cash assets on Dec. 31, 1900, after paying dividends on the preferred stock and all other charges were $10,046,360. The previous year the same item stood at $5,471,693. The increase during the last year amounted to $4,574,667.

The Pelton Engineering Co., Cleveland, O., has removed its office and factory to the corner of Merwin and James sts., where facilities will be increased. The company is prepared to design and install complete power and lighting plants. It is the Cleveland representative of the Thomas Carlin's Sons Co., of Allegheny, Pa.

DEVELOPMENT OF STEEL MANUFACTURE IN THE UNITED STATES.

Andrew Carnegie contributes to the *Evening Post* of New York, a resume of the remarkable advance in steel manufacture made in the United States in the last 25 years, the most surprising developments coming in the past 10 or 15 years. Mr. Carnegie says in part:

Five years ago had one asked the steel-makers of the country whether there was any likelihood of the Bessemer process being rivalled, not one in a thousand would have hesitated to reply with an emphatic, never! But the one in a thousand, conversant with recent experiments, would have been less emphatic and intimated that perhaps even the Bessemer process might not remain without a rival.

The merits of the open-hearth Siemens furnace has been noted by at least one firm whose representative visited concerns abroad. The Thomas basic process was found to be remarkably well adapted to the open-hearth furnace, and an enterprising party in England had made some scientific experiments with it. To Cooper, Hewitt & Co. is due the credit of having been the first to experiment with it in the United States. The cost of open-hearth steel was necessarily greater than the Bessemer, and so was restricted to few uses, but a new plant was only needed on a large scale, ready to benefit by the numerous improvements which clever men made in the course of development, to place the new process securely upon its feet as a rival to the Bessemer. There are now two kinds of steel made in the open-hearth, the acid and the basic, the latter much cheaper than the former, though even purer, since the basic process eliminates the impurities thoroughly. Basic open-hearth steel is now used as a substitute for Swedish iron in many instances, even for horseshoes. Armor is made of it. The East River bridge is to be built of acid steel, for which a higher price is paid, but this is solely because its engineer is not open to demonstration. Its great advantage to the United States is that our enormous quantities of ores containing high phosphorus can be used for steel, while the Bessemer process requires ores comparatively free from this, the supply of which is limited. The product of open-hearth steel is rapidly increasing.

Thus, the age of iron, which passed away during the last century, was succeeded by the age of Bessemer steel, which enjoyed a reign of only 36 years, beginning, as it did, in 1864, and is in turn now passing away to be succeeded by the age of Siemens open-hearth steel. Already the product of open-hearth is far beyond that of Bessemer in Britain, and such the writer ventures to predict will soon be the case in the United States.

The passing away of the Bessemer age has brought the South into prominence as a possible manufacturer of steel, when otherwise it never would have been in the field, its ores being unsuitable for the Bessemer, but probably soon to be proved to be adapted for the open-hearth process. Until the new steel works of the Tennessee company have been fully started and run for some time it cannot be completely demonstrated whether steel can be made there cheap enough to make the South a great center for its manufacture. The experimental stage has not yet been clearly passed, since only part of the plant has been operated, but there seems little reason to doubt that any difficulties which may be met with will finally be overcome, and that the South is to become an important factor in steel manufacture.

The Steel Making Center.

The present center of steel is in the square made by a line drawn from Pittsburg to Wheeling, northward to Lorain, eastward to Cleveland, and south again to Pittsburg. In this territory most of the steel is made. Allegheny county alone (Pittsburg) in 1899 produced nearly one-quarter of all the pig-iron in the United States, almost half of the open-hearth steel, and almost 39 per cent of total production of all kinds of steel. As far as the writer sees, there is little chance of this region being soon displaced; Colorado will, no doubt, expand as the Western coast is developed; Chicago's position as a steel-manufacturer is assured. There is no sign of the great Southwest making steel to any extent. As late as the middle of the last century the Eastern States upon the Atlantic constituted the home of steel-manufacture. Even in Pennsylvania the half of all the steel was made east of the Alleghany Mountains. Since then the trend has been constant and rapid to the region known as the Central West, which has Pittsburg as its metropolis. The transfer of the great Lackawanna Iron and Steel Works of Scranton, Pa., to Buffalo, and the splendid triumphs of the Bethlehem Co. (Pennsylvania) in armor, guns, and forgings, as specialties which give it a unique and commanding position, are proofs that for the making of ordinary steel the location is not favorable. The history of the steel-works at Troy is another case in point. There is one exception to this march westward at Harrisburg, in eastern Pennsylvania, which remains a prosperous and important center of manufacture. The Maryland Steel Co. at tidewater has advantages for export, but probably more important for the future of that company is its developments in shipbuilding, for which it is peculiarly well adapted. So far as the writer sees there is nothing to change the national center of steel manufacture in the new century; it is in the Central West already described, and there it is likely to remain.

In that center itself there are causes at work which may lead to some important changes. The wonderful growth of the lake cities on the northern border of the Central West region is shown by the recent census. These possess the advantages of the extremely low cost of lake transportation, the Welland Canal, by which vessels of considerable tonnage can load at Conneaut and other lake ports direct for Europe, and above all, the low rates which the Erie canal insures manufacturers for more than half the year. These are attracting attention especially since an effort is being made to weld the trunk railway lines into one directorate to enable them to exact higher rates of freight when lower prices for service or articles seem to be the prevailing law. The selection of Buffalo by the Lackawanna Steel Co. for its new works is evidence of a movement to the lakes. The policy of the railroad combination will inevitably operate in favor of the southern ports and to the disadvantage of New York. The differential of 3c per hundred in favor of Baltimore and 2c in favor of Philadelphia over New York certainly means that the traffic will continue to seek these ports, and that New York's percentage of the shipping trade will steadily fall, as it has been doing. It is not to be supposed that the city and State of New York will fail to protect their position by improving the weapon which New York State alone of all States has in her waterway from the lakes to the port of New York. The writer takes this for granted, and consequently predicts a great development in steel manufacture in that part of the Central West lying along the southern border of Lake Erie, which will inure to the benefit of New York as being the port which may be reached cheapest from the Central West by water. One of the features of the coming century is to be a return to water transport for heavy materials. Lake ships of 7,000 tons burden already exist. Barges will ply upon the Ohio River, soon to be slack-watered, and upon the enlarged Erie Canal, as also that from Chicago to the Mississippi; and many other waterways will be opened upon which the raw materials for steel and the finished article itself are to be carried by manufacturers at rates already reached upon the lakes, one-third and often one-fourth those charged by rail.

It is scarcely within the bounds of belief that any cheaper or better process of making steel remains to be discovered, or that much improvement upon present methods can possibly be such as greatly to reduce cost and enable steel to be made without loss at less than 3 pounds for 2 cents. The twentieth century, with all its wonders yet to be revealed, will probably end with the manufacture of steel substantially as it is now, by the open hearth. There does not seem room for much improvement.

The United States the World's Purveyor.

The last few years have witnessed the export of steel from our country to other lands. The republic has not only supplied her own wants, but is competing to supply the wants of the world, not only in steel, but in the thousand and one articles with which steel is the chief component part. The cheapness with which steel is made is multiplying its uses to such an extent that estimates made of the possible wants of the world in the future can only be guesses. One illustra-

tion out of many that could be given is that three years ago there was not a ton of steel used for railway-freight cars; today a thousand tons of steel per day are used for that purpose alone—indeed, so rapidly is the use of steel extending that is is difficult to see how the world's demands can be filled. At present the mines of ironstone and of coking coal in Britain are worked to their fullest capacity, and yet the output is not greatly increased; it is the same with those of Germany, except that in the latter country there remain some inferior fields capable of development if prices rise, as is probable. Russia so far has not been much of a factor in steel-making; if she is able to supply her own wants by the middle of the century she will be doing well. Except by the United States, Britain, and Germany, little steel is made, nor is any other nation likely to make much. The hopes in regard to China and Japan making steel, the writer believes, are to prove delusive. Britain and Germany cannot manufacture much beyond what they do now, so that the increased wants of the world can be met only by the United States. The known supply of suitable ironstone here is sufficient to meet all possible demands of the world for at least half of the century; in the case of coke for the entire century. It is not to be supposed that other deposits will not be discovered before known supplies are exhausted.

A few years hence the export of steel and manufactures of steel from the republic to many parts of the world, which in 1899 were valued at $119,000,000, promises to be so great as to constitute another chapter in the record-breaking history of steel.

The influence of our steel-making capacity upon development at home must be marvelous, for the nation which makes the cheapest steel has the other nations at its feet as far as manufacturing is concerned in most of its branches. The cheapest steel means the cheapest ships, the cheapest machinery, the cheapest thousand and one articles of which steel is the base. We are on the eve of a development of the manufacturing powers of the republic such as the world has never seen, and the writer who is honored by being asked to write for the *Evening Post* its record of the twentieth century may present figures as surprising as I have to submit for the nineteenth.

The republic's progress and commanding position as a steel producer are told in a few words: In 1873, only twenty-seven years ago, the United States produced 198,796 tons of steel; Great Britain, her chief competitor, 653,500 tons, more than three times as much. Twenty-six years later, 1899, the republic made more than double as much as the monarchy, the figures being 10,639,957 and 5,000,000 tons respectively an eight-fold increase for Britain and fifty-three-fold for the republic, and almost 40 per cent of all the steel made in the world, which was 27,000,000 tons. Industrial history has nothing to show comparable to this.

So much for the past; as for the future, ere the present century runs one-third its course, perchance one-fourth, the United States is to make more steel than all the rest of the world combined, and supply the wants of many lands besides her own.

Received From the Trade.

Air Hoists.—The Northern Engineering Works, Detroit, Mich., in a 16-page catalogue, 6x9 inches, present details of their air hoists and other pneumatic lifting appliances. The catalogue points out that the use of air hoists has revolutionized the cost of handling the product in many plants and refers to the company's long experience in manufacturing and marketing hoisting appliances. The catalogue is intended to supplement the one issued by the same company and devoted to cranes. Dimension tables and diagrams showing air consumed, etc., are given in detail.

Calendars.—Calendars for 1901 have been received from the Philip Carey Mfg. Co., Lockland, O., manufacturers and patentees of Carey's magnesia flexible cement roofing; Thomas A. Mack & Co., Cincinnati, O., pig iron and coke, and Bethlehem Steel Co., South Bethlehem, Pa., manufacturers of steel forgings, castings, etc.

Iron and Steel.—A. M. Castle & Co., Chicago, have sent out their yearly calendar, and their January stock book and catalogue. The latter contains a number of changes from the previous issue, particularly in respect to stock carried in warehouse. A complete line of special machinery for boiler shops, railroad shops, ship yards, etc., is carried. The company is the exclusive Western sales agent for the Reading Iron Co., Reading, Pa.; Lukens Iron & Steel Co., Coatsville, Pa.; The Champion Rivet Co., Cleveland, and the Chambersburg Engineering Co.

Gas Engines.—"Built for business," is the designation the Pierce-Crouch Engine Co., New Brighton, Pa., give to their Brighton gas and gasoline engines, on the calendar and circular recently sent out. Among the features of these engines are the straight-line principle of construction, the auxiliary piston valve, self-oiling phosphor-bronze bearings and an automatic starter.

Copper Handbook.—"The Copper Handbook," by Horace J. Stevens, Houghton, Mich., assistant commissioner of mineral statistics for the State of Michigan, is a book of 328 pages, in which copper production, copper mines and copper shares are fully covered. It is intended primarily for reference, and the aim has been to present information in a convenient form. The price of the book is $1.00 in paper, $1.75 in cloth, and $2.50 in full morocco.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market and Some of Their Wants:

The Pacific Steel Co. has been incorporated according to New Jersey law, with capital of $1,000,000. It is one of the Peter Whitney enterprises and the incorporators are associated with him. The company will at first engage in general mining, and eventually take up the manufacture of iron and steel.

The Southern Engine & Boiler Works, Jackson, Tenn., will make improvements to its plant, to cost about $30,000.

It is reported that the Carbon Steel Co., Pittsburg, has leased the old west shore shops at East Buffalo, N. Y., adjacent to the Pullman shops, where it will establish a steel axle plant. President Robertson, of the Carbon Steel Co., and Dr. W. Seward Webb are said to be interested.

James D. Shields, treasurer of the Chester Woolen Co., and Horace G. Cooke, formerly Eastern representative of the Connersville Blower Co., have purchased the plant at Paterson, N. J., formerly known as the Paterson Iron Co. The new company is incorporating under the name of the Paterson Iron & Steel Forge Co., and the following are the officers: president and general manager, Horace G. Cooke; vice-president and treasurer, James D. Shields; secretary, George A. Beckworth. The plant will be considerably improved and the latest appliances used for the making of iron and steel forgings.

The Orangeburg, (S. C.) Machine & General Repair Shops is in the market for a 10-inch swing lathe fifteen feet long and small foundry outfit complete.

Theo. Hiertz & Son, 2935 Park avenue, St. Louis, Mo., is in the market for machinery for twisting from two to four-ply annealed wire No. 20 to 25.

The Murray Company, Dallas, Tex., recently incorporated to manufacture square-bale cotton presses and to conduct general machinery and manufacturing business, has purchased the plants of the Murray Ginning System Co. and the Texas Gin & Machine Co., and will operate same.

The Cherokee Iron Works, Blacksburg, S. C., has been chartered, with capital stock of $30,000.

The J. L. Means Machinery Co., Ltd., Shreveport, La., has been incorporated, with capital stock of $50,000, to manufacture machinery and boilers.

T. W. Lambert, Mint Spring, Va., wants a three-spindle boring machine to carry 11-16-inch bits for boring chair posts; also power-feed rod machine to make chair rods.

The Dudley-Carper Mfg. Co., St. Louis, Mo., recently inporporated, succeeds A. W. Dudley & Co. in the manufacture of machinery, dies, tools, models and patterns. The company has purchased the New Hietts Machine Co.'s plant, which about doubles its capacity.

Messrs. McFarland will establish a foundry and machine shops in Jonesboro, Mo.

Thomas Bailey, of the Bailey Foundry and Machine Works,

Athens, Ga., contemplates establishing a foundry at Elberton, Ga.

The new shafting department of the Republic Iron & Steel Co., at Valley plant, was opened on Jan. 21. It is fully equipped and up-to-date.

The Ravenna boiler works, Ravenna, O., have been sold to the John F. Byers Machine Co. They had been operated a number of years by Jones Bros., and made all the boilers for the Byers Machine Co., besides a large outside business. Hereafter the company will manufacture its own boilers.

The Stokes & Smith Co. of Camden, N. J., has been incorporated with a capital stock of $100,000. The company will manufacture tools and machinery. Harry B. Smith, Philip S. Smith and J. S. Stokes are the incorporators.

The Buffalo Foundry Co. of Buffalo, N. Y., has been incorporated with a capital of $10,000. Charles F. Dunbar, William J. Hayes and E. G. Rippel are the incorporators.

The Whitehead Co. of Davenport, Ia., has been incorporated with a capital of $40,000. J. H. Flick is president of the company, E. S. Johnson, vice-president; W. W. Whitehead, manager; B. F. Piatt, secretary, and Dr. A. L. Hageboeck, treasurer. It was erroneously stated last week that the company would buy and sell second-hand machinery. It will deal in new engines, boilers, tools and machinery.

The Canton Sheet & Plate Co. of Canton, O., has been granted a West Virginia charter with a capital of $1,000, with the privilege of increasing to $200,000. William J. Steele, A. Pomerene, E. Pomerene, E. P. Bockers, C. H. Curtis and S. C. Taylor are the incorporators.

The Cleveland (O.) Cap Screw Co., capital $250,000, has elected D. J. Kurtz president; Fred E. Bright, vice-president; H. V. Bright, general manager and treasurer, and S. M. Mathews, secretary. The company has purchased the plant of the Grant Machine Tool Co. in Cleveland, giving it a floor space of 35,000 square feet. Machinery will be installed at once.

The Ferricup Metal Co. has been granted a New Jersey charter with a capital of $100,000. Edgar Harding, Roland Worthington, George H. Blake, Edward Burbeck and H. A. Wyman are the incorporators.

The Clinton Separator and Engine Co. of Clinton, Ia., has been granted a charter with a capital of $50,000. The new concern will manufacture engines and power machinery. J. D. Lamb, Hugh Robertson, W. O. Pratt, S. W. McKee and M. J. Gates are the incorporators.

The Compound Lever Co. of Chicago, has been incorporated with a capital of $10,000. The new concern will manufacture machinery and machinery appliances. R. F. Pettibone, H. E. Osborn and J. C. Burchard are the incorporators.

Fires and Accidents:—

Fire destroyed the Fairbank & Timme machine shops and foundry, Appleton, Wis., on Jan. 16. Loss about $3,000.

The plant of the E. W. Ross Co., Lagonda, O., was damaged by fire on Jan. 14, to the extent of about $75,000. The foundry and warehouse were partially destroyed. Insured at $65,000.

The main plant of the E. W. Ross Mfg. Co. of Springfield, O., was totally destroyed by fire last week. The loss is estimated at $100,000.

The plant of the Tuttle & Bailey Mfg. Co. of Brooklyn, N. Y., was badly damaged by fire last week.

New Construction:—

The New York, New Haven & Hartford R. R. Co. has started the foundation for new and extensive car shops at Readville, Mass.

An addition 100 feet long will be built at the Norwood Engineering Co.'s plant, Northampton, Mass.

The Lloyd Booth Co., Youngstown, O., is compelled to enlarge its foundry, because of increasing business. The addition will be 80x56 ft. An order was received recently from the Kilby Mfg. Co., Cleveland, to build a number of large miscellaneous castings for the new pumping station at Cleveland.

Haworth & Pucker, Hickory, Mo., will rebuild their foundry and machine shop recently burned.

It is stated that Carl Schinke, constructing engineer for the McMyler Mfg. Co.'s new plant at Warren, O., will organize a company for the purpose of building a large foundry adjoining the McMyler Works.

The National Steel Co. has already let contracts for increasing the capacity of its rail mill at Youngstown, O. The mill will be lengthened 100 feet and new drill and straightening presses will be placed in the addition. The Lloyd Booth Co. of Youngstown has been awarded the contract for the beds and transfer tables while the American Bridge Co. will erect the mill extension.

The American Bridge Co. has decided to erect a reaming plant for railroad work in connection with its works at Youngstown, O.

The Springfield Bridge & Iron Co. of Springfield, O., will erect a new plant 60x140 feet in size. A new site has been secured on which the other buildings of the company will be centralized.

The Alabama Machine Works, Decatur, Ala., have been purchased by H. K. Adams and Robert Dyas, who will enlarge and improve the same.

The Montreal Rolling Mills of Montreal, Que., have decided to build a steel and pipe mill in Cape Breton. The plant will have an annual capacity of 20,000 tons of pipe, 2-inch and above.

The Prescott Iron Works of Menominee, Wis., will erect an addition to its machine shop 70x50 feet.

Ground was broken last week for the new billet mill of the Newport Rolling Mill Co., at Newport, Ky. The building will be 350x400 feet in size.

The Pittsburg District:—

The McClintic-Marshall Construction Co. of Pittsburg, which recently purchased 4½ acres at Rankin, last week put men at work on the land grading it preparatory to erecting the new plant.

During the past week it developed that the American Tin Plate Co. is negotiating with the Sharon Steel Co. of Sharon, Pa., for the purchase of the entire output of its 20-mill tin plant as soon as placed in operation. It is also reported that the American Steel & Wire Co. has submitted a proposition to the company for the purchase of its entire output of wire, nails and rods. A meeting of the directors of the company is to be held this week for the purpose of considering the propositions presented.

The National Tube Co. last week shipped 15 miles of 6-in. pipe to Beaumont, Tex., from plants in the Pittsburg district, to be used in piping the oil from the big gusher tapped there several weeks ago.

The Buffalo, Rochester & Pittsburg Coal Co. of Pittsburg, has purchased 3,000 acres of coal land in Indiana county, Pa.

At a meeting of the stockholders of the Pittsburg, Bessemer & Lake Erie railroad held at Pittsburg last week, it was decided to lease the road to the Carnegie Co. under the proposition guaranteeing the minority stockholders 3 per cent on their common stock. The new company, subsidiary to the Carnegie Co. will take charge of the road on April 1, and its stock issue of $500,000 will be held by the Carnegie Co. Ex-Judge J. H. Reed will continue as president and Robert A. Franks as secretary-treasurer. The directors of the new company are W. W. Blackburn, D. M. Clemson, Robert A. Franks, W. E. Corey, James Gayley, Thomas Morrison, Edwin S. Mills, James H. Reed and Joseph E. Schwab.

In the past week William C. Klee, of Allegheny, acquired a controlling interest in the Damascus Bronze Co. of Pittsburg.

The Allegheny Roll & Machine Co. of Pittsburg, with a capital of $1,000, was granted a Pennsylvania charter last week. This company is subsidiary to the Allegheny Iron & Steel Co., which is building a plant at Tarentum, Pa.

Thomas Fawcus resigned recently as superintendent of the R. D. Nuttall Co. of Pittsburg. The Fawcus Machine Co. has been organized for the manufacture of gears of all kinds and of special machinery, and to do general machine work.

Chicago District and Northwest:—

The Cleveland Cliffs Iron Co. will build a thoroughly up-to-date charcoal furnace at Marquette, Mich., with a daily capacity of 150 tons.

A stock company is being formed in Beaver Dam, Wis.,

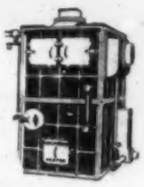
What is the Temperature of Your Boiler Feed-Water?

Do you, Mr. Steam Plant Owner, know this? Mighty few owners, or even their engineers, know for a fact exactly what temperature the water has just before it enters their boilers.

Engine indicators are worth what they cost, and yet such a little thing as a thermometer (which can be bought for a couple of dollars) may tell you a tale of loss in the coal pipe double or treble what the indicator could save you! You ought to find out the temperature, for it is an excellent index as to whether one item of your expense account (your fuel cost) is wholly necessary, or part waste.

If you have exhaust steam for heating your boiler feed-water the temperature of the latter ought to be about 210°. For every 10° that its temperature is below this it means that over 1 per cent of your fuel is being wasted. If it has only 160° it means over 6 per cent! If such a loss does exist you can stop it by buying one of our

Cochrane Feed-Water Heaters



and the saving will pay for the Heater in a very short time.

Is it not, therefore, of interest to find out what your feed-water temperature actually is?

Don't assume because the pipe "feels hot" that you are getting the full temperature; or that because you have a Heater you are saving all that is possible; the Heater may be inefficient, or it may not be large enough, owing to the growth of your plant.

Our catalogue will tell you of other advantages of the COCHRANE HEATERS.

Harrison Safety Boiler Works, Clearfield & 17th Streets, PHILADELPHIA, PA.

with a capital of $65,000, to establish a malleable steel range plant. More than half of the stock has already been subscribed.

Plans are being prepared for a factory building for the Andrews Wire & Iron Works, Rockford, Ill. The building will be 50 by 164 feet in size, and will cost $6,000.

M. J. Morehouse, architect, Mallers Building, Chicago, has prepared plans for a plant to be built at Chicago Highlands, a suburb, for the American Novelty Castings Co. The main building will be 550 by 110 feet, one story, of brick and steel, with composition and asphalt roof, and equipped with an electric crane. There will also be several other buildings, and 14 furnaces. An electric plant will be installed. The cost of the plant will be about $50,000.

W. L. Stebbings, engineer, 1111 Monadnock, Chicago, will let contracts for a factory building to be built on Western Ave. and W. 18th St., Chicago, for H. W. Caldwell & Son Co. It will be four-story and basement, 160 by 70 feet, of brick, stone and iron. This building is one of a number recently built and to be built for the Caldwell company to be used in the manufacture of elevating, conveying and power transmission machinery.

The Gates Iron Works, 650 Elston Ave., Chicago, has recently installed an 80-foot span 20-ton electric traveling crane and equipped its machine shop with 6 heavy lathes, 4 boring mills and other new tools. This new equipment will increase the capacity of the plant about 40 per cent. The company reports a steady increase in business, especially from South America and Australia. The increase in export trade in 1900 over 1899 was about 25 per cent, while the total increase in the company's business was 40 per cent in the year.

General Industrial Notes:—

By a vote of the majority of the stockholders the Cornwall Iron Co. of Lebanon, Pa., has decided to dissolve and wind up its affairs.

The sale of the Trussville Furnace, Trussville, Ala., has been postponed until Jan. 28.

At a meeting of the stockholders of the Youngstown Iron & Steel Roofing Co. at Youngstown, O., last week, it was decided to increase the capital stock from $250,000 to $300,000.

It is reported that the Richmont Electro-Galvanized Tube Co. of Milwaukee, will remove its plant to Waukegan, Ill. A stock company is to be organized at the latter place with a capital stock of $250,000 to operate the plant.

The Pennsylvania railroad company has ordered 40 new engines to be built at the Altoona, Pa., shops.

The John F. Byers Machine Co. of Ravenna, O., has been reorganized by the election of C. G. Fisher as president and F. P. Chapman vice-president, and M. Collins secretary and treasurer.

At the annual meeting of the Brier Hill Iron & Coal Co. of Youngstown, O., held last week, George Tod was elected president; Henry Tod, vice-president; H. H. Stambaugh, secretary and treasurer, and J. G. Butler Jr., general manager.

The *Railroad Gazette* of Jan. 18 contains the following locomotive and car statistics: The Richmond Locomotive & Machine Works will build 50 locomotives for the Wabash; The Baldwin Locomotive Works, 25 locomotives for the Erie, 22 instead of 20, as reported, for the Choctaw, Oklahoma & Gulf, one for the Pittsburg, Bessemer & Lake Erie, and one for the Jacksonville & Southwestern; the Schenectady Locomotive Works, 4 locomotives for the Chicago, St. Paul, Minneapolis & Omaha; the International Power Co., 4 locomotives for the Cuba Company. The American Car & Foundry Co. has orders for 1,000 freight cars, part box and part coal, for the International & Gt. Northern; 50 cars for the Iowa Central, and 400 freight cars for the State Railroads of Chili; the Pressed Steel Car Co., 75 gondola cars for the Pittsburg Coal Co.; the Illinois Car & Equipment Co., 800 additional box cars for the Atchison, Topeka & Santa Fe, which road will probably buy 1,000 coal cars; the American Steel Foundry Co., 100 cars for the Goodwin Car Co.; the Rodger Ballast Car Co., 60 Rodger ballast cars for the Pere Marquette. The Choctaw, Oklahoma & Gulf has ordered 400 box cars from the Mt. Vernon Car Mfg. Co., 300 box cars from the Southern Car & Foundry Co., and 100 box cars from the Georgia Car & Mfg. Co. The Cudahy Packing Co., Omaha, Neb., is in the market for 250 refrigerator cars. The Missouri, Kansas & Texas will soon be in

Pig Iron

Made in Alabama by the SLOSS-SHEFFIELD STEEL & IRON COMPANY. . . .

FOUR FIRST CLASS BRANDS.

"Sloss," "Sheffield," "Florence,"

"Lady Ensley."

We handle nothing but Good Iron and Foundry Coke.

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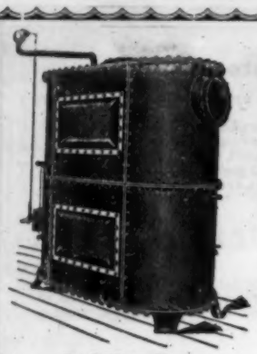
THE ROBERT FIELD COMPANY,

45-46 Board of Trade, COLUMBUS, O.

1012-1013 Union Trust Bldg., ST. LOUIS, MO.



Feed-Water Heater.

FEED WATER HEATERS

Cut herewith illustrates Stillwell's latest design. Made entirely of cast iron. Saves fuel and filters the feed water for steam boilers. Use only exhaust steam.

BOILER FEED PUMPS

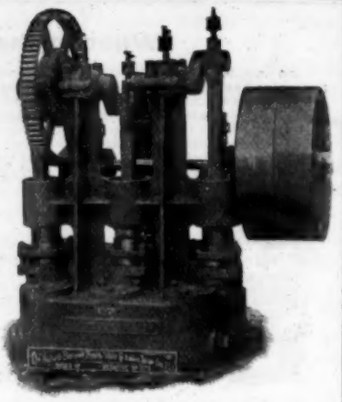
SINGLE, DUPLEX AND TRIPLEX.

AIR COMPRESSORS

JET-CONDENSERS-SURFACE

IF INTERESTED ADDRESS

The Stillwell-Bierce & Smith-Vaile Co., 227 Lehman Street, DAYTON, OHIO, U. S. A.



Triplex Boiler Feed Pump.

the market for about 2,000 cars, and the Green Bay & Western for about 100 box cars.

The New Era Iron Works Co., Dayton, O., manufacturer of the New Era gas engine, will install a number of new milling machines, lathes, automatic tools, etc. Though this plant was newly equipped a year ago, the great demand for its engines compels the company to increase its facilities.

The three roofing plants at Niles, O., the Sykes, the Niles Iron & Steel and the Curtis, of Warren, O., have been acquired by the National Roofing & Corrugating Co., which now controls about 80 per cent of the roofing plants of the country.

The Atlantic furnace, New Castle, Pa., is installing two large upright Wheeler boilers.

James Campbell, trustee for the creditors of the Sontinental Iron Co., has filed an application for an order to sell the personal property of the company, amounting to $80,000. An order has also been asked to sell the mill in Niles, O., to business men there, who wish to purchase the plant and place it in operation.

Orders so far secured by the United States Cast Iron Pipe & Foundry Co. run ahead of those for the same period of 1900. The plant at Newport, Ky., will be blown in shortly to meet requirements.

Mills Nos. 7 and 8 of the Greer plant of the American Tin Plate Co., at New Castle, Pa., resumed on Jan. 21, after several weeks' idleness, caused by the engine breaking down.

A strike in the Nixon shipyards, Elizabeth, N. J., has tied up the yard and threatens to delay work now in progress on ships for the navy, including five submarine boats. The men sent delegates to demand the discharge of non-unionists, but the delegates were themselves discharged.

The Brown-Bonnell Bessemer plant of the Republic Iron & Steel Co., at Youngstown, O., resumed on double turn Jan. 21, after a two weeks' idleness. Considerable improvements have been made. At the Valley mill, the 7, 9 and 12-in. mills and the two puddle mills resumed operations Jan. 14. The big bar mill resumed Jan. 15 and the little bar mill, Jan. 16.

The Cowles & Danziger Co., Detroit, Mich., owing to the success of its interlocked steel barrel, has increased its capitalization, and has removed to a larger plant at the corner of Wight and Iron sts. The officers of the company are: President, R. R. Sterling; vice-president, F. G. Skinner; secretary and treasurer, A. A. Cowles; superintendent, J. C. Danziger, M. E.

The rail finishing department of the Ohio steel plant, Youngstown, O., will resume early in February. The mill has been on billets and tin bars recently, and during this time several new soaking pits have been built, bringing the capacity of the rail mill up to that of the blooming mill. The new continuous finishing mill will be placed in operation March 1. The No. 3 blast furnace will probably be ready to blow in by April 1.

At the annual meeting of the stockholders of the Southern Engine & Boiler Works of Jackson, Tenn., directors were elected as follows: W. P. Timberlake, W. T. Harris, J. W. N. Burkett, W. B. Cole, M. S. Neely, E. Burkett, R. Witherspoon, W. E. McClamrock and S. D. Hays. The directors elected the following officers: Dr. M. S. Neely, president; W. E. McClamrock, vice-president; E. Burkett, secretary and treasurer.

At the annual meeting of the American Bell Foundry of Northville, Mich., directors were elected as follows: Chas. Filkins, W. Phillips, W. J. Lanning, R. C. Yerkes, E. S. Lapham, F. S. Harmon and Chas. Shaw. The directors elected the following officers: F. S. Harmon, president; Chas. Filkins, vice-president; Wm. Phillips, secretary, and E. H. Lapham, treasurer.

At the annual meeting of the Vulcan Iron Works Co. of Toledo, O., Alex Backus was elected president and secretary; W. H. A. Read, vice-president; S. A. Hunter, treasurer.

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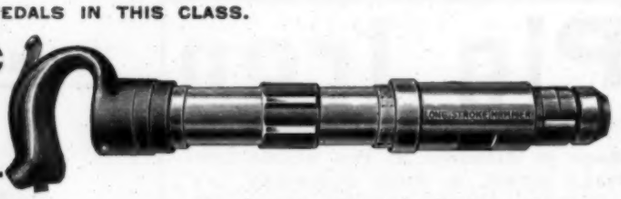

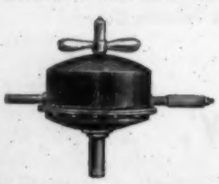

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Youngstown, O., will be blown in about Feb. 1. Several new rings were added at the top of the stack by the Sharon Boiler Co. of Sharon, Pa., and the furnace was relined. It will start on Bessemer iron.

The Savannah Foundry & Machine Co. of Savannah, Ga., was declared bankrupt in the United States court at Savannah.

The Petroleum Iron Works of Washington, Pa., have recently completed the installation of a complete hydraulic riveting plant. A power punch manufactured by the Hilles-Jones Co. of Wilmington, Del., has also been installed. The company manufactures riveted boilers, riveted tubing, pipe, cylinder tanks, and the sides of pressed steel car tanks.

At the annual meeting of the stockholders of the Michigan Wire Cloth Co. of Detroit, Mich., the following officers were elected: W. J. Chittenden, president; F. H. Croul, vice-president; Hugh O'Connor, secretary and treasurer; Charles F. Purdee, superintendent. The above, with George H. Hopkins and W. H. Brace, constitute the board of directors.

The report that the Haselton works of the Republic Iron & Steel Co., at Haselton, O., would be started up in the near future is untrue. This plant, which contains puddling furnaces, bar mill and sheet mills, has not been operated since it was taken over by the Republic Iron & Steel Co., and it is an old plant and may possibly never be operated again.

J. B. Doan & Co., machine tools, 68-70 South Canal street, Chicago, will continue in business as heretofore, having decided not to make the combination reported some weeks ago.

The Chester B. Albree Iron Works, Allegheny, Pa., have recently taken orders for three 26-inch riveters for export to Germany; one 86-inch riveter to drive 1½-inch diameter rivets for Christiania, Norway; two 36-inch alligator riveters to drive 1⅛-inch diameter rivets for the New York Ship Building Co.; two 102-inch riveters, for Colorado; one 18-inch standard bridge riveter for the Haskell, Barker Car Co., Michigan City, Ind.; one 12-foot gap stationary boiler riveter, of about 30,000 lbs., to drive 1¼-inch diameter rivets, requiring a pressure of 300,000 lbs., for the marine boiler works of Heipershausen Brothers, of New York City. They also have under contract three large mill buildings and orders aggregating nearly 25,000 feet of bridge railing.

It is rumored that the Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., has purchased the property of the Etna

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FIREBRICK, KY.

Furnace Co., near Cedartown, Ga., consisting of 8,000 acres of mineral lands and furnace; it is said the furnace will be overhauled and blown in and several hundred tons of iron ore mined daily.

A semi-annual dividend of 4 per cent has been declared on the preferred stock of the Colorado Fuel & Iron Co., payable Feb. 15. This dividend covers the first half of the current fiscal year. Last month the last of the overdue dividends on the preferred stock were paid. No dividend has been declared as yet on the common stock. The company has not completed the enlargements to be made in its plant, and some stock will have to be sold for this purpose.

The Alabama Bridge Works, Dacatur, Ala., will be enlarged at a cost of $45,000.

The Cleveland Punch & Shear Works Co., Cleveland, put its new battery of boilers in operation Jan. 17, and will soon have its new engine installed and running. With modern electrical equipment throughout its shops, the company expects to have one of the most complete plants in the country for the production of heavy tools. Recent orders include one from the Government for one of the company's heavy punches for the Mare Island Navy Yard; an order for a 72-inch multiple punch for Ohio Cultivator Co., Bellevue, O., and eight punches for the American Car & Foundry Co., Detroit.

The new blast furnace which the American Steel & Wire Co. has been adding to its central group in Cleveland was put in blast Jan. 17. It is 100x21 feet, and is capable of an output of 550-600 tons daily. This is the first new furnace built in Cleveland since 1887, when the second Central furnace was built.

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"METALLURGY OF CAST IRON."

James M. Swank, author of "Iron in All Ages," and editor of the *Bulletin* of the American Iron & Steel Association, in reviewing "Metallurgy of Cast Iron" says it is "one of the most valuable publications relating to the manufacture of iron castings that has ever, to our knowledge, been issued in this or any othe country."

The *Engneering Magazine* (New York) in reviewing this book says: "The author of this treatise is doubtless the highest authority in the United States upon the metallurgy of cast iron. He has, in our opinion, done more to advance the art of iron founding than any other man of the period."

C. F. Blakesly, general manager Du Quoin Iron Works Co., Du Quoin, Ill.: "'Metallurgy of Cast Iron' should be in the hands of every progressive foundryman, and, in fact, every one who has to do with castings."

Chas. S. Booth, president the Oakland Iron Works, Oakland, Cal., says: "I consider 'Metallurgy of Cast Iron' the most complete, comprehensive and exhaustive work yet issued. I have found Part III., which treats on the science of mixing and melting iron, especially valuable, and do not think that a manager or owner of any foundry can make better use of his time and money than to purchase a copy of this work and study it carefully, and then apply the knowledge derived therefrom to the practical operations of his business."

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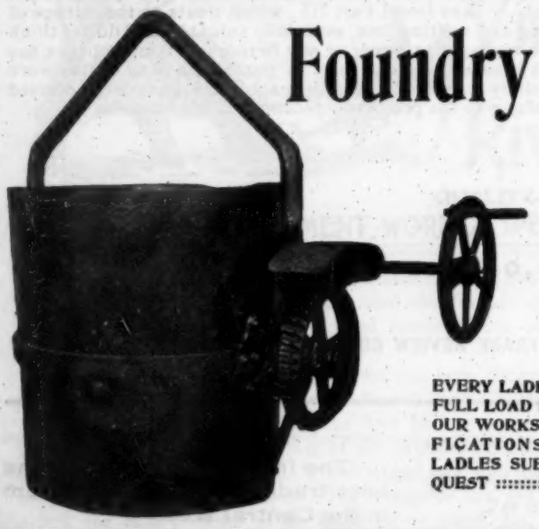

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15	13	11		12	14	16
P.M.	P.M.	A.M.	LV AR.	A.M.	A.M.	P.M.
4:35	1:05	7:05	Lorain	9:10	11:30	6:37
4:40	1:20	7:20	Elyria	8:54	11:16	6:23
4:56	1:38	7:41	Grafton	8:35	10:59	6:05
5:15	1:57	8:00	Lester	8:15	10:41	5:47
5	3	1	Main Line	2	4	6
4:40	1:00	7:10	Cleveland	9:10	11:40	6:40
4:54	1:16	7:24	Brooklyn	8:54	11:24	6:26
5:45	2:02	8:14	Lester	8:10	10:40	5:40
5:56	2:11	8:23	Medina	7:55	10:30	5:26
6:19	2:30	8:43	Seville	7:33	10:10	5:05
6:26	2:36	8:49	Sterling	7:27	10:04	4:59
6:48	2:58	9:11	Warwick	7:05	9:42	4:35
6:56	3:05	9:18	Canal Fulton	6:58	9:35	4:28
7:16	3:23	9:39	Massillon	6:40	9:18	4:11
7:31	3:40	9:58	Justus	6:24	9:03	3:55
8:01	4:11	10:26	Canal Dover	5:55	8:34	3:26
8:08	4:18	10:33	New Philade	5:48	8:27	3:18
8:25	4:35	10:50	Uhrichsville	5:30	8:10	3:00
	4:50	11:15	D. " A.		8:10	3:00
	6:50	1:15	Bridgeport		6:10	1:00
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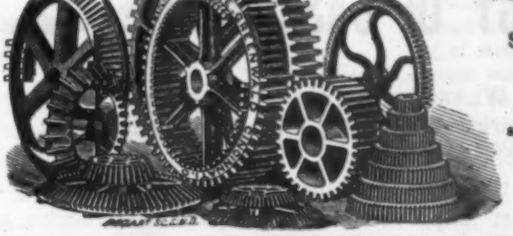

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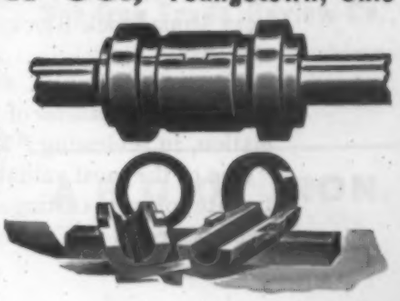

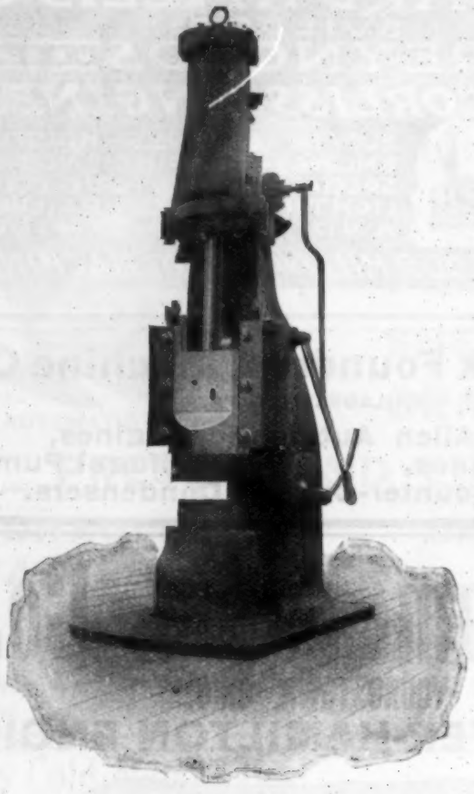

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600 "	22	5 x 11	17½	2	2½
800 "	25	6 x 12½	20	2	2½
1000 "	28	6 x 13	22½	2½	3
1250 "	30	7 x 13	23½	2½	3
1500 "	33	7 x 14½	25	2½	3

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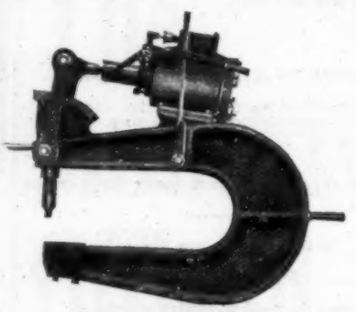

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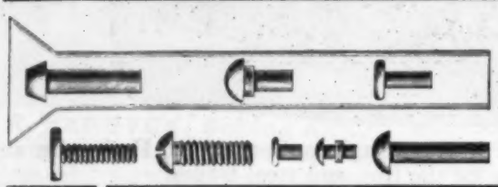

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James M. Swank, author of "Iron in All Ages," and editor of the *Bulletin* of The American Iron & Steel Association, in reviewing "Metallurgy of Cast Iron," says it is "One of the most valuable publications relating to the manufacture of iron castings, that has ever, to our knowledge been issued in this or any other country."

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CREMER & BICKNELL'S

Chemical and Metallurgical

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EXTRACT FROM PREFACE:

In the preparation of the second edition of our Handbook, the general plan of the first edition has been followed, viz., to present in concise form such data and information as are useful to the chemist and metallurgist. Several tables of the first edition, which were of somewhat limited use, have been omitted, while more than one hundred pages of new matter have been added.

The methods for analysis of iron ore, iron and steel and for assaying have been given briefly, but perhaps as much in detail as is consistent with the general scope of the book. Several changes and additions to the Specific Gravity tables have been made by adoption of later and more accurate values.

In the notes on blast furnace practice have been outlined the more important theoretical and practical points, which, it is hoped, will be of some service to those interested in the manufacture of iron.

The hygrometric table gives the necessary information for determining the amount of moisture in air, a subject whose importance in metallurgical operations is being more fully recognized at present than heretofore. This table is new and is based on the most accurate data available at the present time.

The tables of weights and measures, United States and foreign, have been very much amplified, and the conversion tables for United States and metric weight and measures of the U. S. Coast and Geodetic Survey included, the latter being based on the legal standard for this country.

Numerous miscellaneous tables have been added, which, it is hoped, will be found of value

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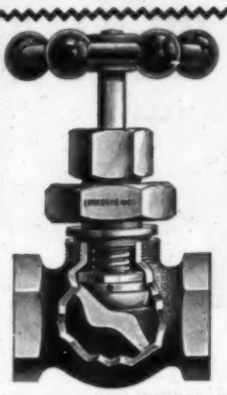
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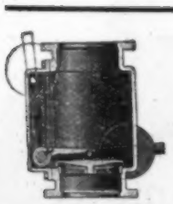
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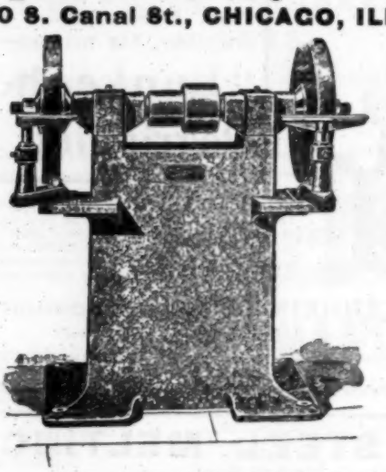

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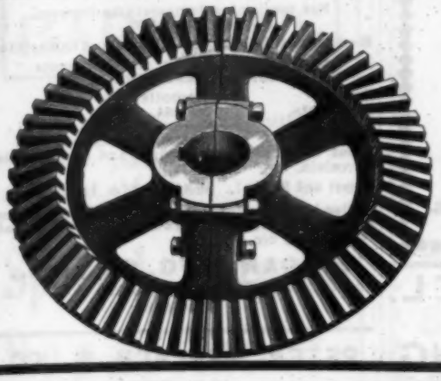

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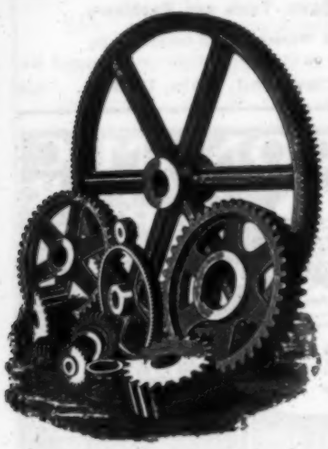

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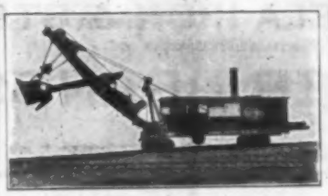

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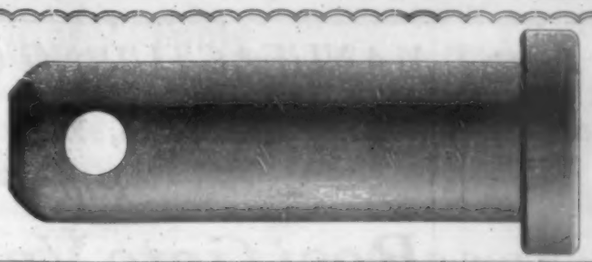

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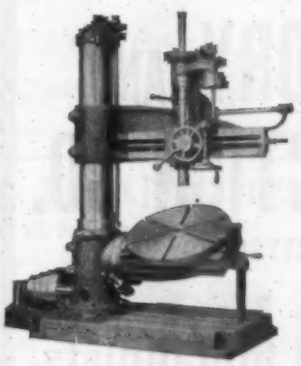

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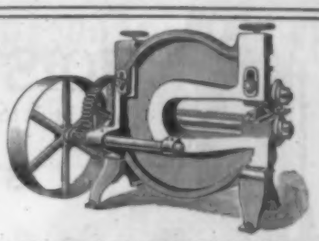

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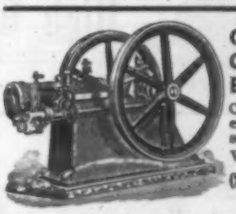

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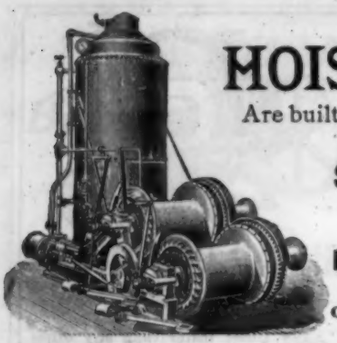

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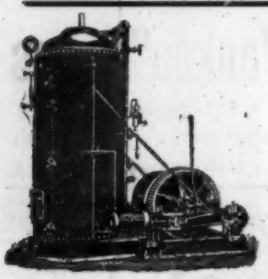

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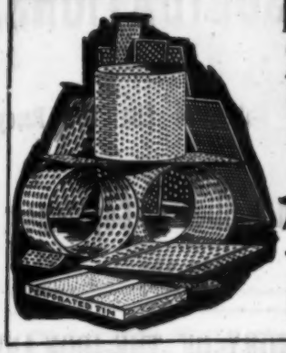

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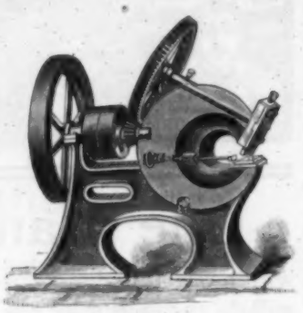

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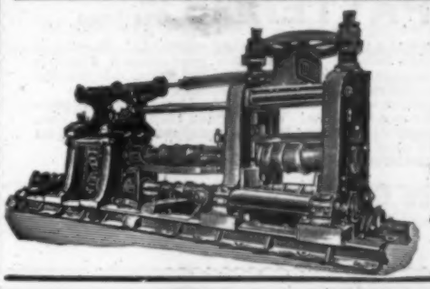

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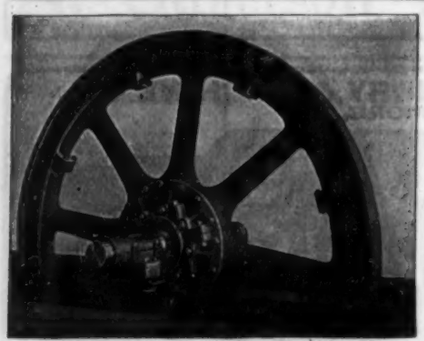

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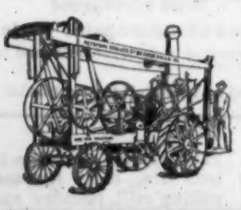

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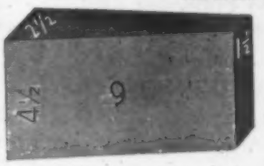

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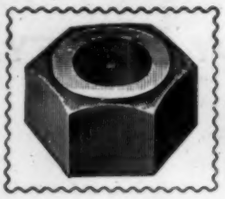

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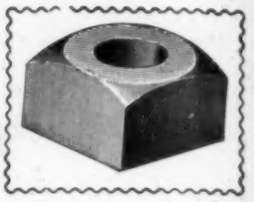

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The Best Mfg. Co., Pittsburg, Pa.
Brass Founders' Supply Co., Newark, N. J.
Hooven, Owens & Rentschler Co., Hamilton, O.
Jeffrey Manufacturing Co., Columbus, O.
W. A. Jones Foundry Co., Chicago, Ill.
Link Belt Machinery Co., Chicago, Ill.
Massillon Iron & Steel Co., Chicago, Ill.
Lorain Foundry Co., Lorain, O.
Geo. B. Sennett Co., Youngstown, O.
Seaman-Sleeth Co., Pittsburg, Pa.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
West Penn Foundry & Machine Co., Avonmore, Pa.

CASTINGS (ALUMINUM)—
J. J. Ryan & Co., Chicago, Ill.

CASTINGS (BRASS)—
The Best Manufacturing Co., Pittsburg, Pa.
Lorain Foundry Co., Lorain, O.
The Lunkenheimer Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.

CASTINGS (BRONZE)—
The Best Mfg. Co., Pittsburg, Pa.
Lorain Foundry Co., Lorain, O.
J. J. Ryan & Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.

CASTINGS (MALLEABLE)—
Acme Steel & Malleable Iron Works, Buffalo.
Meadville Malleable Iron Co., Meadville, Pa.

CASTINGS (STEEL)—
Acme Steel & Malleable Iron Works, Buffalo.
Bethlehem Steel Co., South Bethlehem, Pa.
Otis Steel Co., Cleveland, O.
The Sargent Co., Chicago, Ill.

CAULKING HAMMERS—
Cleveland Pneumatic Tool Co., Cleveland, O.
Chicago Pneumatic Tool Co., Chicago, Ill.

CEMENT—
Reed F. Blair & Co., Pittsburg, Pa.
Garden City Sand Co., Chicago, Ill.

CHAIN—
Standard Chain Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

CHAIN BELTING—
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.

CHANNELERS—
The Ingersoll-Sergeant Drill Co., New York.

CHANNELS—
American Steel Hoop Co., New York City.

CHEMISTS—
Geo. C. Davis, Philadelphia, Pa.
F. A. Emmerton, Cleveland, O.
Grasselli Chemical Co., Cleveland, O.
The R. W. Hunt & Co., Chicago, Ill.
O. Texter, Cleveland, O.

CHILLED AND SAND ROLLS—
Canton Roll & Machine Co., Canton, O.
Frank-Kneeland Machine Co., Pittsburg, Pa.
A. Garrison Foundry Co., Pittsburg, Pa.
Lorain Foundry Co., Lorain, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Wm. Tod & Co., Youngstown, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
West Penn Foundry & Machine Co., Avonmore, Pa.

CHIPPING HAMMERS—
Cleveland Pneumatic Tool Co., Cleveland, O.
Chicago Pneumatic Tool Co., Chicago, Ill.

CHUCKS—
Somers, Fitler & Clarke, Pittsburg, Pa.

COAL CUTTERS—
The Ingersoll-Sergeant Drill Co., New York.
Jeffrey Mfg. Co., Columbus, O.
Link Belt Machinery Co., Chicago, Ill.

COAL SCREENS—
Rob't Aitchinson Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.
Western Machinery & Supply Co., Chicago, Ill.

COAL AND COKE—
Alabama Consolidated Coal & Iron Co., Birmingham, Ala.
Bessemer Coke Co., Pittsburg, Pa.
Reed F. Blair & Co., Pittsburg, Pa.
Cherry Valley Iron Co., Pittsburg, Pa.
A. M. Crane & Co., Chicago, Ill.
H. C. Frick Coke Co., Pittsburg, Pa.
The Rob't Field Co., Columbus, O.
O'Gara, King & Co., Chicago, Ill.
M. A. Hanna & Co., Cleveland, O.
J. H. Hillman & Son, Pittsburg, Pa.
Jerome Keeley & Co., Philadelphia, Pa.
McKeefrey & Co., Leetonia, O.
Pilling & Crane, Philadelphia, Pa.
Pickand, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

COAL HANDLING MACHINERY—
The Atlas Car & Mfg. Co., Cleveland, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.

COAL MINING MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.
Link Belt Machinery Co., Chicago, Ill.
Webster, Camp & Lane Machine Co., Akron, O.

COLD SAWS—
J. R. Vandyck, New York City, N. Y.

COMPAROMETERS—
Vulcan Mfg. Co., Pittsburg, Pa.

COMPRESSION COUPLINGS—
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, O.

CONDENSERS—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

CONTRACTORS' SUPPLIES—
A. Leschen & Sons Rope Co., St. Louis, Mo.

CONVEYING MACHINERY—
American Engineering Works, Chicago, Ill.
A. Leschen & Sons Rope Co., St. Louis, Mo.

CONVEYORS—
Exeter Machine Works, Pittston, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.
The Brown Hoisting Machinery Co., Cleveland.
Webster Camp & Lane Machine Co., Akron, O.

COPPER GASKETS—
Drake Acetylene Apparatus Co., Cleveland, O.

CORE OVENS—
Millett Core Oven Co., Brightwood, Mass.

CORRESPONDENCE SCHOOLS—
International Correspondence Schools, Scranton, Pa.

CORRUGATED IRON—
Berger Mfg. Co., Canton, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
American Sheet Steel Co., New York City.

COTTON TIES—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.

CRANES—
Atlas Machine Co., Pittsburg, Pa.
The Brown Hoisting Machinery Co., Cleveland.
The Bucyrus Co., South Milwaukee, Wis.
Cleveland Crane & Car Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O., and Chicago.
Marion Steam Shovel Co., Marion, O.
Torbert & Peckham, Chicago, Ill.
R. D. Wood & Co., Philadelphia, Pa.
Wm. Tod & Co., Youngstown, O.

CRANES AND DERRICKS—
A. Leschen & Sons Rope Co., St. Louis, Mo.

CRANK PINS—
Bethlehem Steel Co., S. Bethlehem, Pa.

CRUSHING MACHINERY—
Raymond Bros. Impact Pulverizer Co., Chicago.

CUPOLAS—
Riter-Conley Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Wm. B. Pollock Co., Youngstown, O.
S. Obermayer Co., Cincinnati, O., and Chicago, Ill.
The United Boiler Co., Girard, O.

DECALCOMANIAS—
Scientific Manufacturing Co., Chicago, Ill.

DIES—
American Steel & Wire Co., Chicago, Ill.
Danielson Machine & Tool Co., Cleveland, O.

DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
The Jeffrey Mfg. Co., Columbus, O.
Thew Automatic Shovel Co., Lorain, O.

DRILL GRINDERS—
J. Wendell Cole, Columbus, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

DRILLING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

DRILL PRESSES—
C. H. Besly & Co., Chicago, Ill.
Jos. E. Bissell, Agt. Prentiss Tool & Supply
U. Baird Machinery Co., Pittsburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

DROP FORGINGS—
E. D. Clapp Mfg. Co., Auburn, N. Y.
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia.
Wyman & Gordon, Worcester, Mass.

DROP HAMMERS—
Cleveland Punch & Shear Wks. Co., Cleveland.

DROP PRESSES—
Avery Stamping Co., Cleveland, O.
Bethlehem F'dry & Mach. Co., Bethlehem, Pa.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
Cleveland Punch & Shear Wks. Co., Cleveland.
Danielson Machine & Tool Co., Cleveland, O.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELECTRICAL MACHINERY SUPPLIES—
A. Leschen & Sons Rope Co., St. Louis, Mo.
Pelton Engineering Co., Cleveland, O.

ELECTRICAL WIRES AND CABLES—
American Steel & Wire Co., Chicago, Ill.

ELEVATING AND CONVEYING MACHINERY—
The Aultman Co., Canton, O.
American Engineering Works, Chicago, Ill.
The Brown Hoisting Machinery Co., Cleveland, O.
Exeter Machine Works, Pittston, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
Webster Camp & Lane Machine Co., Akron, O.

EMERY AND CORUNDUM WHEELS—
C. H. Besly & Co., Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

EMERY WHEEL MACHINERY—
C. H. Besly & Co., Chicago, Ill.
J. Wendell Cole, M. E., Columbus, O., or Chicago.
Northampton Emery Wheel Co., Chicago, Ill.

ENGINEERS AND CONTRACTORS—
American Engineering Works, Chicago, Ill.
Alex. Laughlin & Co., Pittsburg, Pa.
The Best Manufacturing Co., Pittsburg, Pa.
E. E. Erickson, Pittsburg, Pa.
Garrett-Cromwell Engineering Co., Cleveland.
Jeffrey Mfg. Co., Columbus, O.
Julian Kennedy, Pittsburg, Pa.
David Lamond, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville.
Pittsburg Valve, Foundry & Construction Co., Pittsburg, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wellman-Seaver Engineering Co., Cleveland, O
Walter Kennedy, Pittsburg, Pa.

ENGINE PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Il.
Jenkins Bros., New York City.
The Lunkenheimer Co., Cincinnati, O.
The Crane Co., Chicago, Ill.
Drake Acetylene Apparatus Co., Cleveland, O.
Wright Mfg. Co., Cleveland, O.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

ENGINES (Oil) —
The Aultman Co., Canton, O.

ENGINES (Steam)—
The Aultman Co., Canton, O.
The Edward P. Allis Co., Milwaukee, Wis.
The Hooven, Owens & Rentschler Co., Hamilton, O.
Somers, Fitler & Clarke, Pittsburg, Pa.
Wm. Tod & Co., Youngstown, O.
Vulcan Iron Works, Wilkes-Barre, Pa.
Wickes Bros., Pittsburg, Pa.

ENGRAVERS AND ELECTROTYPERS—
Rosenow & Co., Chicago, Ill.

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
Wm. B. Scaife & Sons, Pittsburg, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

FELLOE PLATES—
Avery Stamping Co., Cleveland, O.

FILES, MAKERS OF—
C. H. Besly & Co., Chicago, Ill.

FILTER PRESSES—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

FILTERS—
Pittsburg Filter Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

FIRE BRICK AND CLAY—
Chicago Fire Brick Co., Chicago, Ill.
Clearfield Fire Brick Co., Clearfield, Pa.
Crown Fire Clay Co., Akron, O.
Dover Fire Brick Co., Cleveland, O.
John H. Ehlen, Newport, Ky.
Garden City Sand Co., Chicago, Ill.
A. J. Hawes & Son, Johnstown, Pa.
F. B. Holmes & Co., Detroit, Mich.
Kentucky Fire Brick Works, Portsmouth, O.
Keystone Fire Clay Co., Lisbon, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
S. Obermayer Co., Cincinnati, O., and Chicago.
Reese-Hammond Fire Brick Co., Bolivar, Pa.
J. V. Rose & Son, Sharon, Pa.
F. B. Stevens, Detroit, Mich.
Scioto Star Fire Brick Works, Portsmouth, O.
A. F. Smith & Co., New Brighton, Pa.
Scioto Fire Brick Co., Sciotoville, O.
Union Mining Co., Mt. Savage, Md.
Webster Fire Brick Co., South Webster, O.

FIRE PROOF COVERING—
C. H. Besley & Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Bethlehem Steel Co., South Bethlehem, Pa.
Chicago Drop Forge & Foundry Co., Kensington, Ill.
E. D. Clapp Mfg. Co., Auburn, N. Y.
Cleveland City Forge & Iron Co., Cleveland, O
Frankford Steel & Forging Co., Philadelphia.
Wyman & Gordon, Worcester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg, Pa.
Geo. B. Sennett Co., Youngstown, O.
Pilling & Crane, Philadelphia, Pa.
Vulcanus Forging Co., Cleveland, O.

FOUNDRIES—
E. R. Allen, Corning, N. Y.
The Aultman Co., Canton, O.
Best Mfg. Co., Pittsburg, Pa.
Brass Founders' Supply Co., Newark, N. J.
Hooven, Owens & Rentschler Co., Hamilton, O.
Jeffrey Mfg. Co., Columbus, O.
W. A. Jones Foundry Co., Chicago.
Link Belt Machinery Co., Chicago, Ill.
Pittsburg Valve, Foundry & Construction Co., Pittsburg, Pa.
Seaman, Sleeth Co., Pittsburg, Pa.
Wm. Tod & Co., Youngstown, O.
Wheeling Mold and Foundry Co., Wheeling, W. Va.

FOUNDRY EQUIPMENT—
Jos. E. Bissell, Agt. Prentiss Tool & Supply
The W. J. Clark Co., Salem, O.
Brass Founders' Supply Co., Newark, N. J.
Cleveland Crane & Car Co., Cleveland, O.
Co., Pittsburg, Pa.
Chicago Pneumatic Tool Co., Chicago, Ill.
Macleod & Clark, Cincinnati, O.
Millett Core Oven Co., Brightwood, Mass.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O., and Chicago.
Tabor Mfg. Co., Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.
S. Obermayer Co., Cincinnati, O., and Chicago.

FOUNDRY SUPPLIES—
Brass Founders' Supply Co., Newark, N. J.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co., Cleveland, O.
John H. Ehlen, Newport, Ky.
Cleveland Facing Mill Co., Cleveland, O
Chicago Fire Brick Co., Chicago, Ill.
Crown Fire Clay Co., Akron, O.
Dover Fire-Brick Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
A. J. Haws & Son, Johnstown, Pa.
F. B. Holmes & Co., Detroit, Mich.
Kentucky Fire Brick Works, Portsmouth, O.
Keystone Fire Clay Co., Lisbon, O.
Millett Core Oven Co., Brightwood, Mass.
Newport Sand Bank Co., Newport, Ky.
Northern Engineering Works, Detroit, Mich.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
S. Obermayer Co., Cincinnati, O., and Chicago.
The Ohio Sand Co., Conneaut, O.
Reese-Hammond Fire Brick Co., Bolivar, Pa.
J. V. Rose & Son, Sharon, Pa.
Scioto Fire Brick Co., Sciotoville, O.
Somers, Fitler & Clarke, Pittsburg, Pa.
A. F. Smith & Co., New Brighton, Pa.
F. B. Stevens, Detroit, Mich.
Scioto Star Fire Brick Works, Portsmouth, O.
Tabor Mfg. Co., Philadelphia, Pa.
Union Mining Co., Mt. Savage, Md.
Vulcan Mfg. Co., Pittsburg, Pa.
Webster Fire Brick Co., South Webster, O.
Webster Foundry Sand Co., Philadelphia, Pa.

FRICTION METAL—
C. H. Besly & Co., Chicago, Ill.
Theo. Hiertz & Son, St. Louis, Mo.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FUEL OIL BURNERS—
Rockwell Engineering Co., New York City.

GAGE COCKS—
The Lunkenheimer Co., Cincinnati, O.

GALVANIZED IRON—
American Sheet Steel Co., New York City.
McCullough Iron Co., Wilmington, Del.

GALVANIZERS—
American Sheet Steel Co., New York City.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Atlas Machine Co., Pittsburg, Pa.
Columbus Machine Co., Columbus, O.
Miller Improved Gas Engine Co., Springfield.
Northern Engineering Works, Detroit, Mich.
Somers, Fitler & Clarke, Pittsburg, Pa.

GAS PRODUCERS—
R. D. Wood & Co., Philadelphia, Pa.

GAUGES (Rolling Mill)—
Haines Gauge Co., Philadelphia, Pa.

GEARING—
James Bonar & Co., Pittsburg, Pa.
F. H. Bultman & Co., Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
The Van Dorn & Dutton Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Link Belt Machinery Co., Chicago, Ill.
The R. D. Nuttall Co., Allegheny, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

GEAR CUTTERS—
F. H. Bultman & Co., Cleveland, O.

GEAR CUTTING—
F. H. Bultman & Co., Cleveland, O.
The Van Dorn & Dutton Co., Cleveland, O.
The R. D. Nuttall Co., Allegheny, Pa.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B. Scaife & Sons, Pittsburg, Pa.

GRINDING MACHINERY—
Raymond Bros. Impact Pulverizer Co., Chicago.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos. Dixon Crucible Co., Jersey City, N. J.

HACK SAWS—
Cleveland Punch & Shear Wks. Co., Cleveland

HANGERS—
The Aultman Co., Canton, O.
E. A. Delano, Chicago, Ill.
I. & E. Greenwald Co., Cincinnati, O.
Dodge Mfg. Co., Mishawaka, Ind.
Link Belt Machinery Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
The United Boiler Co., Girard, O.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.

HOISTS—
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Aultman Co., Canton, O.
The Edward P. Allis Co., Milwaukee, Wis.
Exeter Machine Works, Pittston, Pa.
Lidgerwood Mfg. Co., New York City.
Somers, Fitler & Clarke, Pittsburg, Pa.
Torbert & Peckham, Chicago, Ill.
Vulcan Iron Works, Wilkes-Barre, Pa.
Webster, Camp & Lane Machine Co., Akron, O.

HOISTING MACHINERY—
The Aultman Co., Canton, O.
The Brown Hoisting Machinery Co., Cleveland, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.
Exeter Machine Works, Pittston, Pa.
Link-Belt Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Webster, Camp & Lane Machine Co., Akron, O.

HOISTING ROPE (Wire)—
American Steel & Wire Co., Chicago, Ill.

HORSE SHOES—
American Steel & Wire Co., Chicago, Ill.
Phoenix Horse Shoe Co., Joliet, Ill.

HYDRAULIC TOOLS—
R. D. Wood & Co., Philadelphia, Pa.

INDUSTRIAL CARS—
The Atlas Car & Mfg. Co., Cleveland, O.
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
American Bridge Co., New York City.
Illinois Steel Co., Chicago, Ill.
Wm. B. Scaife & Sons, Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
McCullough Iron Co., Wilmington, Del.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON ORES—
Drake, Bartow & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Jerome Keeley & Co., Philadelphia, Pa.
Lake Superior Consolidated Iron Mines, New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Tod, Stambaugh & Co., Cleveland, O.
J. Wesley Pullman, Philadelphia, Pa.

IRON WORKING MACHINERY—
Atlas Machine Co., Pittsburg, Pa.

IRON WORKING TOOLS—
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Avery Stamping Co., Cleveland, O.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
Bethlehem F'dry & Mach. Co., S.Bethlehem,Pa
Bickford Drill & Tool Co., Cincinnati, O.
H. Bickford, Lakeport, N. H.
Jos. K. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
F. H. Bultman & Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland.
Thos. P. Conard, Philadelphia, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.
Springfield Machine Tool Co., Springfield, O.
C. C. Wormer Machinery Co., Detroit, Mich.

LADLES—
The W. J. Clark Co., Salem, O.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O., and Chicago.
Wm. B. Pollock Co., Youngstown, O.
The United Boiler Co., Girard, O.

LAG SCREWS—
Vulcanus Forging Co., Cleveland, O.

LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Joseph E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Somers, Fitler & Clarke, Pittsburg, Pa.
Springfield Machine Tool Co., Springfield, O.

LATHE TOOLS—
Armstrong Bros Tool Co., Chicago, Ill.

LINK BELTING—
The Aultman Co., Canton, O.
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.

LOCOMOTIVES—
Hyde Bros. & Co., Pittsburg, Pa.

LUBRICANTS—
The Ironsides Co., Columbus, O.

LUBRICATING DEVICES—
The Lunkenheimer Co., Cincinnati, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

MACHINE TOOLS—
American Engineering Works, Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Atlas Machine Co., Pittsburg, Pa.
U. Baird Machinery Co., Pittsburg, Pa.
C. H. Besly & Co., Chicago, Ill.
Bertsch & Co., Cambridge City, Ind.
Bethlehem F'dry & Mach. Co., S.Bethlehem,Pa
H. Bickford, Lakeport, N. H.
Bickford Drill & Tool Co., Cincinnati, O.
Joseph E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
F. H. Bultman & Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland.
Danielson Machine & Tool Co., Cleveland, O.
Pelton Engineering Co., Cleveland, O.
F. B. Shuster Co., New Haven, Conn.
Somers, Fitler & Clarke, Pittsburg, Pa.
Springfield Machine Tool Co., Springfield, O.
C. C. Wormer Machinery Co., Detroit, Mich.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

MACHINERY AND TOOL STEEL—
American Steel & Wire Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Crescent Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.
Byron H. White, Chicago, Ill.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.

MALLEABLE CASTINGS—
Acme Steel & Malleable Iron Works, Buffalo, N. Y.
Link Belt Machinery Co., Chicago, Ill.
Meadville Malleable Iron Co., Meadville, Pa.

MANILLA ROPE—
A. Leschen & Sons Rope Co., St. Louis, Mo.

MANILLA ROPE COATING—
The Ironsides Co., Columbus, O.

MANUFACTURING CHEMISTS—
Grasselli Chemical Co., Cleveland, O.

METAL BEARINGS—
C. H. Besly & Co., Chicago, Ill.
Theo. Hiertz & Son, St. Louis, Mo.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL SAWS—
J. R. Vandyck, New York City, N. Y.

METAL WORK—
Avery Stamping Co., Cleveland, O.

MILL CASTINGS—
A. Garrison Foundry Co., Pittsburg, Pa.

MILLING MACHINES—
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MILLING MACHINERY—
Raymond Bros. Impact Pulverizer Co., Chicago.

MINING MACHINERY—
The Edward P. Allis Co., Milwaukee, Wis.
American Engineering Works, Chicago, Ill.
The Atlas Car & Mfg. Co., Cleveland, O.
C. H. Besly & Co., Chicago, Ill.
The Bucyrus Co., South Milwaukee, Wis.
Wm. Cramp & Sons, Philadelphia, Pa.
Exeter Machine Works, Pittston, Pa.
Fraser & Chalmers, Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.
Lidgerwood Mfg. Co., New York City.
Link Belt Machinery Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
Wm. B. Pollock Co., Youngstown, O.
Raymond Bros. Impact Pulverizer Co.,Chicago.
Thew Automatic Shovel Co., Lorain, O.
Torbert & Peckham, Chicago, Ill.
Vulcan Iron Works, Wilkes-Barre, Pa.
Webster, Camp & Lane Machine Co., Akron, O.

MINE LOCOMOTIVES—
Jeffrey Manufacturing Co., Columbus, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Somers, Fitler & Clarke, Pittsburg, Pa.
Torbert & Peckham, Chicago, Ill.

MOLDING MACHINES—
S. Obermayer Co., Cincinnati, O., and Chicago.
Tabor Mfg. Co., Philadelphia, Pa.

MOLDING SAND—
John H. Ehlen, Newport, Ky.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.
S. Obermayer Co., Cincinnati, O., and Chicago.
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Webster Foundry Sand Co., Philadelphia, Pa.

MULTIPLE DRILLS—
Bickford Drill & Tool Co., Cincinnati, O.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS (SELF LOCKING)—
National Elastic Nut Co., Milwaukee, Wis.

NUTS AND BOLTS—
National Elastic Nut Co., Milwaukee, Wis.
Milton Manufacturing Co., Milton, Pa.
Upson Nut Co., Cleveland, O.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
Rockwell Engineering Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
The Crane Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

OIL STORAGE TANKS—
Wm. B. Pollock Co., Youngstown, O.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia.

OIL TANKS AND CARS—
Wm. B. Pollock Co., Youngstown, O.

ORE BARROWS—
The Atlas Car & Mfg. Co., Cleveland, O.

ORE CARS—
The Atlas Car & Mfg. Co., Cleveland, O.
The Pressed Steel Car Co., Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.

ORE HANDLING MACHINERY—
The Atlas Car & Mfg. Co., Cleveland, O.
Jeffrey Manufacturing Co., Columbus, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

ORE TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
A. Leschen & Sons Rope Co., St. Louis, Mo.

PAINT—
Jos. Dixon Crucible Co., Jersey City, N. J.
Iron Clad Paint Co., Cleveland, O.
The Ironsides Co., Columbus, O.
Wisconsin Graphite Co., Pittsburg, Pa.

PAINT MACHINES—
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.

PATTERN WORKS—
Balkwill Pattern Works, Cleveland, O.
C. Birnbaum, Cleveland, Ohio.
Forsythe Pattern Works, Youngstown, O.
Gobeille Pattern Co., Cleveland, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON—
Alabama Consolidated Coal & Iron Co., Birmingham, Ala.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Reed F. Blair & Co., Pittsburg, Pa.
Bourne-Fuller Co., Cleveland, O.
Cabeen Co., Philadelphia, Pa.
Cherry Valley Iron Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
A. M. Crane & Co., Chicago, Ill.
The Rob't Field Co., Columbus, O.
M. A. Hanna & Co., Cleveland, O.
Hickman, Williams & Co., Chicago, Ill.
J. H. Hillman & Son, Pittsburg, Pa.
Jerome Keeley & Co., Philadelphia, Pa.
McKeefrey & Co., Leetonia, O.
Pickands, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Pilling & Crane, Philadelphia, Pa.
Republic Iron & Steel Co., Chicago, Ill.
Sloss Sheffield Steel & Iron Co., Birmingham, Ala.
Spearman Iron Co., Sharpsville, Pa.
F. B. Stevens, Detroit, Mich.
Superior Charcoal Iron Co., Grand Rapids, Mich.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

PIPE (CAST IRON)—
A. M. Crane & Co., Chicago, Ill.
Massillon Iron & Steel Co., Chicago, Ill.

PIPE (RIVETED STEEL)—
A. M. Crane & Co., Chicago, Ill.
Wm. B. Pollock Co., Youngstown, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn.
Somers, Fitler & Clarke, Pittsburg, Pa.

PIPE FITTERS—
The Best Manufacturing Co., Pittsburg, Pa.
Pittsburg Valve, Fdy. & Construc. Co., Pittsburg, Pa.

PISTON AIR DRILLS—
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.

PISTON RODS—
Bethlehem Steel Co., South Bethlehem, Pa.

PLANERS—
Atlas Machine Co., Pittsburg, Pa.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Somers, Fitler & Clarke, Pittsburg, Pa.
Springfield Machine Tool Co., Springfield, O.

PLANER TOOLS—
Armstrong Bros. Tool Co., Chicago, Ill.

PLANISHED IRON—
American Sheet Steel Co., New York City.

PLATES—
American Steel & Wire Co., Chicago, Ill.
A. M. Crane & Co., Chicago, Ill.
Enterprise Boiler Co., Youngstown, O.
Illinois Steel Co., Chicago, Ill.
Republic Iron & Steel Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
The Crane Co., Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.
W. J. Schaefer Co., New York City.

PNEUMATIC TOOLS—
American Engineering Works, Chicago, Ill.
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Bethlehem F'dry & Mach. Co., S.Bethlehem,Pa.
Cleveland Punch & Shear Wks. Co., Cleveland.
Danielson Machine & Tool Co., Cleveland, O.

POWER TRANSMISSION MACHINERY—
The Aultman Co., Canton, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
I. & E. Greenwald Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.
Link Belt Machinery Co., Chicago, Ill.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

PRESSES—
Atlas Machine Co., Pittsburg, Pa.
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Bertsch & Co., Cambridge City, Ind.
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Raymond Bros. Impact Pulverizer Co., Chicago.

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The Deming Co., Salem, O.
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The Wm. B. Pollock Co., Youngstown, O.

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RIVETING HAMMERS—
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.

RIVETING MACHINES—
Chicago Pneumatic Tool Co., Chicago, Ill.

RIVET MACHINES—
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

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Raymond Bros. Impact Pulverizer Co., Chicago.

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Rand Drill Co., Chicago, Ill.

ROLL FORGINGS—
Frankford Steel & Forging Co., Philadelphia.
Samuel Trethewey & Co., Pittsburg, Pa.

ROLLING MILL MACHINERY—
Canton Roll & Machine Co., Canton, O.
Frank-Kneeland Machine Co., Pittsburg, Pa.
A. Garrison Foundry Co., Pittsburg, Pa.
Geo. B. Sennett Co., Youngstown, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
The United Boiler Co., Girard, O.
West Penn Foundry & Machine Co., Avonmore, Pa.

ROOFS—
American Bridge Co., New York City.
McCullough Iron Co., Wilmington, Del.
Riter-Conley Mfg. Co., Pittsburg, Pa.
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Somers, Fitler & Clarke, Pittsburg, Pa.
Waterbury Rope Co., New York City.

ROTARY BREAST DRILLS—
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Cleveland Pneumatic Tool Co., Cleveland, O.

SAWING AND DRILLING MACHINERY—
J. R. Vandyck, New York City, N. Y.

SAWS—
Peter Gerlach & Co., Cleveland, O.

SCRAP IRON—
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Hyde Bros. & Co., Pittsburg, Pa.
Illinois Steel Co., Chicago, Ill.
Joseph Schonthal, Pittsburg, Pa.

SCREENS FOR COAL, ORE, ETC.
Robt. Aitchison Perforated Metal Co., Chicago.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.

SCREWS—
C. H. Besly & Co., Chicago, Ill.
Chicago Screw Co., Chicago, Ill.
Upson Nutt Co., Cleveland, O.

SECOND-HAND MACHINERY—
American Engineering Works, Chicago, Ill.
The Atlas Machine Co., Pittsburg, Pa.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
The W. J. Carlin Co., Pittsburg, Pa.
Hyde Bros. & Co., Pittsburg, Pa.
Pelton Engineering Co., Cleveland, O.
Joseph Schonthal, Pittsburg, Pa.
Torbert & Peckham, Chicago, Ill.
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SEPARATING MACHINERY—
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SHAFTING—
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Bethlehem Steel Co., South Bethlehem, Pa.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
Link Belt Machinery Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

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Bertsch & Co., Cambridge City, Ind.
Bethlehem F'dry & Mach. Co., S. Bethlehem, Pa.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland.
Danielson Machine & Tool Co., Cleveland, O.
R. D. Wood & Co., Philadelphia, Pa.

SHAPERS—
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Springfield Machine Tool Co., Springfield, O.

SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SHEET IRON AND STEEL—
American Sheet Steel Co., New York City.
American Steel & Wire Co., Chicago, Ill.
Republic Iron & Steel Co., Chicago, Ill.

SHEET METAL WORK—
The W. J. Clark Co. Salem, O.

SHIP YARDS—
Wm. Cramp & Sons, Philadelphia, Pa.

SOLID STEEL SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SPECIAL MACHINERY—
The Aultman Co., Canton, O.
Avery Stamping Co., Cleveland, O.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland.
Danielson Machine & Tool Co., Cleveland, O.
Jeffrey Mfg. Co., Columbus, O.
Wheeling Mold & F'ndry Co., Wheeling, W. Va.

STACKS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STAND PIPES—
The Wm. B. Pollock Co., Youngstown, O.
The United Boiler Co., Girard, O.

STEAM AND GAS FITTERS' TOOLS—
The Crane Co., Chicago, Ill.

STEAM BOILER INSPECTORS—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

STEAM HAMMERS—
American Engineering Works, Chicago, Ill.

STEAM PIPE AND BOILER COVERING—
C. H. Besly & Co. Chicago, Ill.

STEAM PACKING—
C. H. Besly & Co., Chicago, Ill.

STEAM PUMPS—
Edw. P. Allis Co., Milwaukee, Wis.
Blakeslee Mfg. Co., Du Quoin, Ill.
The Deming Co., Salem, O.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Torbert & Peckham, Chicago, Ill.
R. D. Wood & Co., Philadelphia, Pa.

STEAM SEPARATORS—
Harrison Safety Boiler Works, Philadelphia.
Wright Manufacturing Co., Cleveland, O.

STEAM SHOVELS AND DREDGES—
The Bucyrus, Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
The Thew Automatic Shovel Co., Lorain, O.
Torbert & Peckham, Chicago, Ill.

STEAM SPECIALTIES—
C. H. Besly & Co., Chicago, Ill.
The Crane Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O

STEEL—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Cabeen Co., Philadelphia, Pa.
Champion Iron & Steel Co., Muskegon, Mich.
A. M. Crane & Co., Chicago, Ill.
Crescent Steel Co., Pittsburg, Pa.
Byron H. White, Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa
Otis Steel Co., Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

STEEL BANDS—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.

STEEL BLOOMS AND BILLETS—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.
Cabeen Co., Philadelphia, Pa.
Champion Iron & Steel Co., Muskegon, Mich.
A. M. Crane & Co., Chicago, Ill.
Jerome Keeley & Co., Philadelphia, Pa.
The Lorain Steel Co., Lorain, O.
National Steel Co., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

STEEL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

STEEL CASTINGS—
Acme Steel & Malleable Iron Works, Buffalo, N. Y.
Bethlehem Steel Co., South Bethlehem, Pa.
Otis Steel Co., Cleveland, O.
The Sargent Co., Chicago, Ill.

STEEL CEILINGS—
Berger Manufacturing Co., Canton, O.

STEEL FRAME MILL BUILDINGS—
American Bridge Co., New York City.
Pittsburg Steel Construction Co., Pittsburg, Pa
Wm. B. Scaife & Sons, Pittsburg, Pa.

STEEL HOOPS—
American Steel Hoop Co., Pittsburg, Pa.

STEEL PLANTS—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.

STEEL SHEETS—
American Sheet Steel Co., New York City.
American Steel & Wire Co., Chicago, Ill.
Republic Iron & Steel Co., Chicago, Ill.

STEEL STAMPS—
F. A. Sackmann, Cleveland, O.

STENCILS—
F. A. Sackmann, Cleveland, O.

STOCKS AND DIES—
The Crane Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

TANKS—
The Aultman Co., Canton, O.
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Meehan Boiler & Construction Co., Lowellville, O.
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Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.
The United Boiler Co., Girard, O.

TANK CARS—
Wm. B. Pollock Co., Youngstown, O.

TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa

TIN AND TERNE PLATES—
American Tin Plate Company, New York City.
Champion Iron & Steel Co., Muskegon, Mich.

TIN PLATE MACHINERY—
Canton Roll & Machine Co., Canton, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
West Penn Foundry & Machine Co., Avonmore, Pa.

TOOL HOLDERS—
Armstrong Bros. Tool Co., Chicago, Ill.

TOOL STEEL—
American Steel & Wire Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Crescent Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa
Somers, Fitler & Clarke, Pittsburg, Pa.

TORCHES—
Somers, Fitler & Clarke, Pittsburg, Pa.

TRAMWAYS—
The Atlas Car & Mfg. Co., Cleveland, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.

TRANSMISSION MACHINERY—
The Aultman Co., Canton, O.
The Brown Hoisting Machinery Co., Cleveland, O.
Dodge Mfg. Co., Mishawaka, Ind.
Jeffrey Mfg. Co., Columbus, O.
W. A. Jones Foundry & Machine Co., Chicago.
Link Belt Machinery Co., Chicago, Ill.

TRANSMISSION ROPE (WIRE)—
American Steel & Wire Co., Chicago, Ill.

TROLLEY TRACKS—
The Atlas Car & Mfg. Co., Cleveland, O.
Northern Engineering Works, Detroit, Mich.

TROLLEY WIRES—
American Steel & Wire Co., Chicago, Ill.

TRUCKS—
The Atlas Car & Mfg. Co., Cleveland, O.
Northern Engineering Works, Detroit, Mich.

TUBES—
S. Fix' Sons, Cleveland, O.
National Tube Co., Pittsburg, Pa.

TUBE WELDING—
S. Fix' Sons, Cleveland, O.

TUMBLERS—
Northern Engineering Works, Detroit, Mich.

TURBINE WATER WHEELS—
Stilwell-Bierce & Smith Vaile Co., Dayton, O.

TURNBUCKLES—
Ceveland City Forge & Iron Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

TWIST DRILLS—
C. H. Besly & Co., Chicago, Ill.

TWIST DRILL CASES—
Somers, Fitler & Clarke, Pittsburg, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

VALVES—
C. H. Besly & Co., Chicago, Ill.
The Best Manufacturing Co., Pittsburg, Pa.
The Crane Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
Jenkins Bros., New York City.
Pittsburg Valve Foundry & Construction Co. Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

WASHERS—
Avery Stamping Co., Cleveland, O.
Milton Manufacturing Co., Milton, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

WATER COLUMNS—
Somers, Fitler & Clarke, Pittsburg, Pa.

WATER PIPE—
Massillon Iron & Steel Co., Chicago, Ill.

WATER SOFTENING PLANTS—
Pittsburg Filter Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

WIRE—
American Steel & Wire Co., Chicago, Ill.
Summit Wire Co., Cuyahoga Falls, O.

WIRE COATING—
The Ironsides Company, Columbus, O.

WIRE FENCING—
American Steel & Wire Co., Chicago, Ill.

WIRE FILLER—
The Ironsides Co., Columbus, O.

WIRE MACHINERY—
S. W Goodyear, Waterbury, Conn.
F. B. Shuster Co., New Haven, Conn.

WIRE NAILS—
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE—
American Steel & Wire Co., Chicago, Ill
A. Leschen & Sons Rope Co., St. Louis, Mo.
Waterbury Rope Co., New York City.

WIRE ROPE COATING—
The Ironsides Company, Columbus, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

WIRE ROAP FILLING—
The Ironsides Co., Columbus, O.

WOOD PULLEYS—
Dodge Mfg. Co., Mishawaka, Ind.
Somers, Fitler & Clarke, Pittsburg, Pa.

WROUGHT PIPE—
The Crane Co., Chicago, Ill.
National Tube Co., Pittsburg, Pa.
Pittsburg Valve Foundry & Construction Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

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Cleveland Crane & Car Co	38
†Cleveland Facing Mill Co	—
Cleveland Pneumatic Tool Co	25
Cleveland Punch & Shear Works	41
Clinton Iron & Steel Co	43
Cole, J. Wendell	60
Columbus Machine Co	37
Covert Mfg Co	37
Cramp & Sons, Wm	32
Crane Co., The	31
Crane & Co., A M	53
Crescent Steel Co	34
Crown Fire Clay Co	45
Danielson Machine & Tool Co	60
Davis, George C	60
Delano, E. A	59
Deming Co., The	34
Dixon Jos., Crucible Co	53
Dodge Mfg. Co	42
Dover Fire Brick Co	45
Drake Acetylene Apparatus Co	36
Drake, Bartow & Co	43
Ehlen, John H	44
Emmerton, F. A	2
Enterprise Boiler Co	1
Erickson, Edward E	26
Exeter Machine Works	38
Field & Co., Robert	23
*Fix Sons	43
Forsythe Pattern Works	42
Frankford Steel & Forging Co	47
Frank-Kneeland Machine Co	41
Fraser & Chalmers	34
Frick Coke Co., H. C	1
Gandy Belting Co	60
Garden City Sand Co	45
Garrett-Cromwell Engineering Co	38
Garrison Foundry Co	40
Gerlach, Peter & Co	34
Gobeille Pattern Co	42
Goodyear, S. W	37
Grasselli Chemical Co	34
Greenwald Co., I & E	29
Haines Gauge Co	2
Hall, R. C	25
Hanna & Co., M. A	41
Harrisburg Foundry & Machine Works	52
Harrison Safety Boiler Works	23
Hartford Steam Boiler Insp. & Ins. Co	32
Haws & Sons, A. J	45
Hendrick Mfg. Co., The	39
Hickman, Williams & Co	43
Hiertz & Son, Theo	2
Hillman & Son, J H	1
Holmes & Co., F. B	44
Hooven, Owens & Rentschler Co	33
Hunt & Co., Robt. W	2
Hyde Bros. & Co	52
Illinois Steel Co	52
Ingersoll-Sergeant Drill Co	2
International Correspondence Schools	44
Iron Clad Paint Co	41
Ironsides Co	25
Jeffrey Mfg. Co	44
Jenkins Bros	31
Jones Foundry & Machine Co., W. A	1
Keeley & Co., Jerome	25
Kennedy, Julian	39
Kennedy, Walter	39
Kentucky Fire Brick Works	26
Keystone Driller Co	42
Keystone Fire Clay Co., The	44
Lake Superior Consolidated Iron Mines	43
Lamond, David	39
Laughlin & Co., Alex	39
Leschen & Sons Rope Co., A	37
Lidgerwood Mfg. Co	38
Link-Belt Machinery Co	38
Lorain Foundry Co	40
Lorain Steel Co	51
Lunkenheimer Co., The	31
Marion Steam Shovel Co	60
Massillon Iron & Steel Co	34
McKeefrey & Co	43
Meadville Malleable Iron Co	2
Meehan Boiler & Construction Co	60
Miller Improved Gas Engine Co	2
Millet Core Oven Co	36
Milton Manufacturing Co	48
Monongahela Iron & Steel Co	34
National Elastic Nut Co	37
National Steel Co	48
National Tube Co	48
†Newport Sand Bank Co	—
Northampton Emery Wheel Co	42
Northern Engineering Co	38
Nuttall Co., The R. D	33
Oak Hill Fire Brick & Coal Co	26
Obermayer Co., S	28
O'Gara, King & Co	41
Oglebay, Norton & Co	41
†Ohio Sand Co	—
Otis Steel Co	25
Pelton Engineering Co	52
Perfect Lubricating Metal Co	60
Phœnix Horse Shoe Co	26
Pickands, Brown & Co	43
Pickands, Mather & Co	43
Pilling & Crane	1
Pittsburg Filter Mfg. Co	53
Pittsburg Valve, Foundry & Construction Co	36
Pollock Co., The Wm. B	2
Prescott Steam Pump Co	32
*Pullman, J. Wesley	—
Rand Drill Co	2
Raymond Bros. Impact Pulverizer Co	2
Reese-Hammond Fire Brick Co	44
Republic Iron & Steel Co	1-51
Riter-Conley Mfg. Co	39
*Rockwell Engineering Co	1—
Rosenow & Co	34
Ryan, J. J. & Co	60
Sackmann, F. A	36
Sargent Co., The	50
Scaife & Sons, Wm. B	59
Schonthal, Joseph	52
Scientific Manufacturing Co	39
Scioto Fire Brick Co	45
Scioto Star Fire Brick Works	45
Seaman, Sleeth Co	40
Sennett Co., Geo. B	29
‖Sharon Fire Brick Works	1
Shuster Co., F. B	36
Sloss Iron & Steel Co	47
Sloss Sheffield Steel & Iron Co	47
Smith & Co., A. F	45
Somers, Fitler & Clarke	1
Southwark Foundry & Machine Co	29
Spearman Iron Co	60
Springfield Machine Tool Co	1
Standard Chain Co	44
Stevens, F. B	60
Stilwell-Bierce & Smith-Vaile Co	1-24
Summit Wire Co	50
*Superior Charcoal Iron Co	27
*Tabor Mfg. Co	—
Tennessee Coal, Iron & Railroad Co	47
Textor, O	2
Thew Automatic Shovel Co., The	2
Tod, Stambaugh & Co	43
Tod, Wm. & Co	29
Torbert & Peckham	52-53
Totten & Hogg Iron & Steel Foundry Co	40
Trethewey & Co., Ltd., Samuel	34
Union Mining Co	25
United Boiler Co	39
United States Telephone Co	2
Upson Nut Co	1
Van Dorn & Dutton Co	33
Vandyck, J R	28
*Vulcan Iron Works	37
Vulcan Mfg. Co	34
*Vulcanus Forging Co	35
Waterbury Farrel Foundry & Machine Co	30
Waterbury Rope Co	39
Webster, Camp & Lane Machine Co	26
Webster Fire Brick Co	1
Webster Foundry Sand Co	45
Wellman-Seaver Engineering Co	39
West Penn Foundry & Machine Co	41
Wheeling Mold & Foundry Co	60
White, By on H	34
Wisconsin Graphite Co	21
Wood & Co. R. D	28
Wormer Machinery Co., C. C	52
Wright Manufacturing Co	51
Wyman & Gordon	59

Lake Superior Iron Ore Shipments (Gross Ton

NAME OF MINE.	Prior to 1884.	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	TOTALS.
Marquette Range.																			
American (Sterl'g)	17,123	2,916	.....	.....	1,483	13,699	20,032	21,000	21,604	15,076	.....	.....	.....	.....	.....	.....	.....	.....	112,933
Ames	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,103	5,196	.....	.....	.....	.....	.....	.....	6,299
Barnum (B)	592,841	69,408	47,458	52,975	16,123	10,211	12,835	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	801,851
Bay State	16,637	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,637
Bessie	.....	.....	.....	.....	.....	.....	.....	.....	847	.....	.....	.....	.....	.....	.....	.....	.....	.....	847
Beaufort	24,508	18,360	17,166	17,354	12,829	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,583	91,900
Blue	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13,809	32,171	41,140	.....	2,519	.....	.....	.....	92,639
Boston	59,737	2,218	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	587	.....	.....	.....	.....	62,542
Buffalo (A)	.....	.....	.....	10,860	24,686	30,801	50,919	100,464	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	217,730
Brnastad { Mitch'l	109,109	.....	.....	7,017	16,419	4,091	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	136,636
Brnastad { Wint'p.	329,448	73,144	53,913	58,743	74,067	86,789	155,341	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	831,445
Cambria	167,757	59,742	50,796	58,784	41,130	57,861	72,780	80,359	34,662	41,549	30,445	47,218	41,656	35,086	110,648	102,623	124,930	80,432	1,298,456
Champion	1,239,876	210,180	173,915	137,593	146,330	174,680	215,098	223,442	133,413	109,979	61,648	42,788	100,398	113,375	141,728	163,190	215,074	113,743	3,716,450
Chester	223,505	1,820	3,437	4,403	1,058	402	.....	.....	.....	.....	.....	.....	.....	.....	3,975	.....	.....	22,585	261,185
Chicago	9,012	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9,012
Cleve'd-Cliffs I. Co.	2,849,418	225,674	218,757	203,664	207,441	184,316	274,048	331,713	221,788	310,507	218,105	143,706	221,153	513,119	718,408	869,482	1011,048	881,021	9,603,768
Columbia (Klon'n)	94,813	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	94,813
Curry	.....	.....	.....	.....	.....	.....	16,671	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,671
Detroit	17,716	3,809	19,125	39,400	26,099	18,500	10,112	6,080	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	140,841
Dexter	4,878	16,202	750	.....	.....	1,821	3,895	9,136	5,448	13,000	7,833	21,740	13,752	18,903	1,154	.....	.....	.....	118,512
Dey	.....	2,709	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,709
East Champion	73,305	.....	.....	.....	.....	.....	2,697	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	76,002
East New York	.....	.....	.....	.....	.....	13,094	29,739	36,431	50,203	35,175	911	.....	.....	.....	.....	.....	.....	27,987	194,230
Erie	8,136	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8,136
Etna	1,091	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,091
Fitch	.....	.....	.....	.....	.....	.....	.....	16,550	15,093	.....	.....	.....	174	.....	.....	.....	.....	.....	31,817
Foster (B)	130,626	9,675	9,643	.....	.....	.....	.....	21,949	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	171,893
Gibson	.....	.....	1,515	12,142	2,700	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,357
Goodrich	49,754	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	49,754
G'd Rapids (Davis)	.....	.....	.....	.....	1,200	11,511	20,058	26,426	9,362	22 823	352	12,073	6,764	67	.....	.....	.....	.....	110,736
Hartford	.....	.....	.....	.....	.....	.....	566	.....	.....	5,678	6,513	.....	.....	1,532	.....	.....	.....	.....	14,289
Hortense(N.Ch'p'n)	.....	.....	.....	.....	886	5,585	7,757	16,246	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	30,574
Humboldt	570,825	23,763	11,766	20,207	19,873	11,655	15,866	23,259	19,879	4,571	.....	.....	.....	2,297	.....	.....	.....	.....	723,861
Iron Cliffs (K)	.....	.....	.....	.....	87,346	78,520	134,616	188,776	278,270	289,395	130,812	253,760	259,042	.....	.....	.....	.....	.....	1,700,737
Imperial	.....	.....	.....	.....	.....	.....	.....	38,460	18,552	7,194	.....	.....	.....	.....	.....	.....	23,235	62,321	149,762
Jackson	2,363,270	83,251	68,657	89,370	109,906	101,909	128,891	124,682	92,979	92,567	51,009	32,298	42,186	80,710	79,102	55,012	88,230	31,714	3,715,743
Lake Superior	3,193,764	204,796	226,040	267,622	302,909	240,225	288,784	318,321	308,831	366,715	329,610	344,758	342,439	459,576	376,761	686,563	682,595	709,143	9,669,452
Lillie	114,161	2,683	708	3,957	23,041	32,692	33,916	31,812	19,551	29,005	68,861	78,388	54,285	107,532	112,781	211,023	196,200	114,990	1,235,566
Lucy (McComber)	307,427	.....	.....	.....	12,139	22,276	32,982	43,483	27,683	26,326	21,964	.....	.....	.....	10,033	11,846	.....	.....	516,159
Manganese	397	1,484	3,111	1,367	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,359
Marquette (C)	.....	.....	.....	5,229	20,441	7,060	70,128	23,692	16,802	9,555	.....	.....	.....	.....	.....	.....	.....	.....	152,907
Mesabi's Friend	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,503	10,540	.....	.....	.....	.....	16,043
Michigamme (K)	520,492	25,935	12,373	48,790	58,726	36,448	56,999	80,777	23,169	1,894	935	1,610	3,214	.....	.....	.....	.....	.....	880,362
Milwaukee	87,414	25,991	38,465	46,693	50,490	48,908	52,727	24,763	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	375,451
Moore	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,648	4,648
National	136,229	13,987	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	150,216
Negaunee	.....	.....	.....	.....	5,259	45,304	78,318	76,488	64,218	85,846	69,732	132,581	90,682	175,394	182,169	191,330	195,573	126,829	1,519,722
" Con. Wks.	11,571	43	.....	1,094	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12,708
New York (York)	1,033,324	1,677	.....	.....	5,128	.....	12,844	2,422	.....	11,220	25,000	21,487	.....	.....	.....	.....	6,642	3,327	1,123,071
N. Y. Hematite	37,587	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37,587
Norwood	.....	.....	.....	.....	2,200	3,553	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,753
Nonpareil (St.Law.)	21,959	.....	.....	.....	1,436	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23,395
Pascoe	18,880	12,605	18,249	10,072	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59,806
Pendill	44,399	1,594	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45,993
Phenix (Dalliba)	57,509	.....	.....	.....	1,605	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59,114
Pioneer	.....	.....	.....	5,140	1,203	9,066	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15,409
Pitts. & L. Angel'e	567,282	86,922	111,051	131,731	191,120	223,600	229,670	261,681	241,605	287,517	351,973	355,455	313,555	342,251	489,685	460,333	464,988	389,128	5,509,945
Platt	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,676	5,448	41,226	13,198	11,296	.....	.....	.....	.....	73,844
Primrose	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,040	.....	.....	.....	.....	6,040
Prince of Wales (A)	.....	.....	.....	.....	.....	.....	.....	32,415	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	32,415
Princeton (S'w'n'y)	139,909	3,557	.....	8,328	2,842	.....	.....	.....	7,301	29,403	19,096	.....	6,593	.....	.....	25,247	55,802	75,037	373,175
Quarts	.....	.....	.....	.....	.....	.....	491	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	491
Queen (A)	.....	.....	.....	.....	.....	5,527	66,122	109,217	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	180,866
Queen Group	.....	.....	.....	.....	.....	.....	.....	.....	479,509	379,719	106,864	220,298	160,817	323,057	239,774	61,022	342,978	398,298	2,712,336
Republic	1,815,073	277,757	250,835	211,161	220,624	235,062	287,390	220,065	191,127	167,991	64,195	105,719	174,027	127,360	124,342	140,312	137,085	130,126	4,910,251
Repub. Reduc. Co	.....	.....	.....	.....	87	21,050	22,122	3,915	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47,174
Richards	.....	.....	.....	.....	1,374	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,887	.....	.....	.....	8,261
Richmond	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,088	4,630	24,464	4,613	51,313	86,098
Riverside	.....	.....	.....	.....	.....	5,622	3,712	.....	6,783	.....	43	.....	.....	.....	.....	.....	.....	.....	16,160
Saginaw	446,158	946	.....	.....	.....	.....	.....	.....	4,320	.....	.....	.....	.....	.....	.....	.....	.....	.....	451,424
Salisbury (B)	297,114	26,629	29,503	51,667	48,304	74,947	72,449	85,798	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	686,411
Sam Mitchell	.....	.....	.....	8,823	8,411	546	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17,780
Samson (Argyle)	256,212	1,334	.....	1,133	.....	4,512	2,796	1,218	.....	600	.....	.....	.....	.....	.....	.....	.....	.....	267,805
Section 12	21,887	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	21,887
South Buffalo (A)	.....	.....	.....	.....	4,964	24,706	69,359	146,383	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	245,412
Spurr	163,492	.....	.....	752	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	164,244
Star West (Wheat)	32,623	6,824	9,200	15,867	17,538	4,987	7,997	15,141	4,412	.....	.....	5,550	51,207	9,658	942	.....	6,716	15,987	204,649
Taylor	32,970	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	32,970
Titan	14,906	19,411	23,340	13,865	16,003	2,846	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	90,371
Volunteer	323,999	11,748	5,679	24,034	47,486	56,321	60,156	141,524	92,699	127,130	69,561	26,946	32,672	53,216	1,617	.....	29,983	47,578	1,152,349
Webster	4,443	934	.....	6,229	2,054	.....	448	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	29,797	31,905
West Republic	65,953	19,623	12,700	10,558	12,872	9,861	1,510	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	133,077
Wetmore	4,554	4,585	5,887	10,756	3,335	2,074	19,679	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50,870
Wheeling	.....	4,098	6,383	.....	74	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10,555
Winthrop	.....	.....	.....	.....	.....	.....	.....	109,576	122,042	191,658	180,071	134,365	119,120	150,496	106,894	122,592	171,318	148,945	1,557,077
Miscellaneous	.....	.....	.....	.....	*393	**289	¶893	.....	.....	.....	†1,687	.....	‡1,261	‖1,041	‖986	.....	.....	.....	6,550
Total	18,734,133	1,558,034	1430,422	1627,380	1851,634	1923,727	2642,813	2993,664	2512,242	2666,856	1835,893	2059,330	2097,838	2604,221	2715,035	3125,039	3757,010	3,457,522	59,592,793
Mesabi Range.																			
Adams	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59,141	234,562	170,738	390,860	720,474	777,346	2,353,121
Aetna (Lowmore)	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,645	.....	.....	.....	17,723	.....	.....	.....	.....	19,368
Auburn	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	108,210	376,970	131,478	175,283	235,630	385,992	263,692	.....	1,677,255
Biwabik	.....	.....	.....	.....	.....	.....	.....	.....	.....	151,500	90,048	247,069	242,565	427,464	383,180	553,836	924,868	.....	3,020,530
Canton	.....	.....	.....	.....	.....	.....	.....	.....	.....	24,416	213,853	359,020	16,261	.....	.....	99,498	.....	.....	713,048
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	26,372	.....	17,187	57,324	32,912	.....	246	.....	.....	134,041
Clark	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	63,071	63,071
Cloquet (Vega)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,628	47,700	96,280	12,215	.....	1,621	.....	.....	163,444
Commodore	.....	.....	.....	.....	.....	.....	.....	.....	.....	65,137	7,213	.....	22,063	60,798	80,494	152,947	278,416	.....	667,068
Day	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18,651	1,975	.....	.....	20,626
Duluth	.....	.....	.....	.....	.....	.....	.....	.....	.....	37,626	.....	.....	.....	.....	112,155	165,435	128,587	.....	443,803
Elba	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	564	9,547	121,707	.....	131,818
Fayal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	136,601	248,645	642,939	575,933	1072,257	1,252,504	3,928,579
Franklin	.....	.....	.....	.....	.....	.....	.....	.....	.....	46,617	223,399	286,423	231,086	30,128	200,400	60,000	168,524	1,246,577
Genoa	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17.136	309,514	279,677	276,559	253,651	1,136,537
Hale	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,616	24,167	31,004	70,006	13,728	.....	18,807	32,901	194,229
Kanawha	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	14,963	64,218	79,181
Lake Superior	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	58,123	67,659	259,912	135,404	154,326	284,023	959,447
Mahoning	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	117,884	167,245	519,892	520,751	750,341	911,021	2,987,134
Malta	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28,615	65,346	93,961
Minnewas	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13,858	2,140	.....	.....	.....	.....	.....	.....	15,998
Mtn. Iron (& Rath)	.....	.....	.....	.....	.....	.....	.....	.....	4,245	119,818	573,440	371,274	142,021	773,538	650,955	1137,970	1,001,324	.....	4,774,585
Norman	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	38,999	93,392	77,523	101,077	110,141	.....	.....	.....	421,132
Ohio	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28,048	69,925	47,350	101,607	293,651	172,597	.....	714,073
Oliver (I)	.....	.....	.....	.....	.....	.....	.....	.....	.....	123,015	505,955	500,377	808,291	601,072	349,100	.....	244,876	3,132,686
Penobscot	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11,933	29,652	85,619	146,641	273,845
Pillsbury	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	99,691	106,487	101,032	307,210
Roberts	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18,814	.....	57,847	41,965	118,426
Sauntry	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	53,004	68,560	121,564
Sellers	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47,433	153,037	.....	112,765	174,807	56,280	544,382
Sparta	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	66,722	236,156	287,143	202,144	732,165
Spruce	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	101,675	101,675
Stevenson	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	56,031	56,031
Union	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8,297	8,297
Williams (N. Cin'ti)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,046	11,249	.....	.....	12,357	18,238	44,890
Total	.....	.....	.....	.....	.....	.....	.....	.....	4,245	613,620	1793,052	2781,587	2882,079	4275,809	4613,766	6626,384	7,809,535	31,400,077
Miscellaneous	.....	1,879	441	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,320

A—Now Queen Group. B—Now Iron Cliffs. K—Under Cleve'd-Cliffs I. Co. after '95. I—Mesabi Mtn. and Lone Jack. C—1893 and later in Winthrop. D—Cl

*Iron Mountain. **North Republic. ¶Edison. †Northwest. ‡Schadt. ‖Palmer. ‖‖Ogden.

TOTALS.	NAME OF MINE.	Prior to 1884	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	TOTALS.
	Menominee Range.																			
112,933	Aurora													27,961	110,821	98,847	104,510	93,025	119,940	555,074
6,286	Appleton							1,745	46,609	96,829	4,377	5,618		2,107						12,102
801,551	Aragon							50,275	26,619		167,948	127,901	138,209	183,296	95,809	149,594	295,821	337,807	404,645	2,046,213
16,637	Armenia													2,045						78,969
847	Beta				1,585	1,226				1,400										4,211
91,800	Breen	17,430																		17,430
92,639	Brier Hill	14,981																		14,981
62,542	Bristol (G)										57,352	9,612						80,915	51,639	199,518
217,730	Calumet	35,086	3,627																	38,713
136,626	Chapin	682,413	290,972	157,455	198,871	336,128	290,871	518,990	742,843	488,749	660,052	489,134	235,895	618,589	420,318	643,402	724,768	940,513	929,937	9,369,900
831,445	Columbia	20,282	6,774		14,282	2,377	10,936	11,385	60,133	70,770	57,682	22,426	10,300	70,967	87,202	24,623	14,199	126,290	97,531	708,059
1,298,458	Commonwealth	244,408	34,622	42,947	51,189	56,609	61,818	108,515	116,786	134,982	249,113	151,291	174,921	208,880	93,707	98,283	250,687	117,295	53,342	2,249,295
3,716,450	Cornell	42,672			4,566	2,064														49,302
261,185	Crystal Falls	1,341							3,974					13,037	44,528	95,210	128,235	147,346	197,770	631,437
9,012	Coff																	20,210	38,209	58,419
9,663,768	Cuddy														3,395	41,942	76,877	100,902	141,148	364,264
94,813	Curry (F)	69,238	10,079	4,897		5,376	23,722	72,162	100,681	125,773										416,928
16,671	Cyclops (F)	120,166	24,099	49,897	37,189	14,297	14,693	6,101	7,361	10,599	1,697									286,093
140,841	Delphic	3,410	508	9,880	17,648	2,272									52					33,770
118,512	Doker																			65,192
2,709	Dunn					24,677	118,096	151,828	156,963	162,721	133,666	58,590	24,538	90,885	47,081	31,062	49,381	7,458		1,056,946
76,092	Emmett	66,655															5,000	10,980	49,203	66,655
194,230	Fairbank	8,500																		8,500
8,136	Florence	315,031			8,210	79,399	142,585	196,269	218,570	48,806	48,246	9,634	2,726	22,830	35,136	37,594	93,663	74,235	35,756	1,368,680
1,091	Great Western	23,412	20,710		22,267	23,239	21,866	38,454	72,546	62,464	87,487	661			14,643		33,551	43,316	98,550	563,469
31,817	Groveland									1,049										1,049
171,893	Half and Half							5,961	1,496	67										7,524
16,357	Hamilton				872	600	8,801	8,347	17,072	58,197	2,183									96,072
49,754	Hemlock									35,531	65,459	11,323		949	94,645	96,032	69,865	110,269	72,413	556,486
110,736	Hensel								955											955
14,269	Hiawatha											1,683		1,201					11,008	13,892
30,574	Hilltop																	3,498	6,410	9,906
723,961	Hollister								2,020	1,057	1,021									4,098
1,700,587	Hope										15,543	2,275								17,818
149,762	Indiana	8,642	636	2,739	5,854															17,871
3,715,743	Iron River (H)	129,484	52,581	55,693	78,591	83,018	110,000	179,238	155,458	59,345	1,176									904,587
9,619,452	Keel Ridge	59,465									5,997	3,298		19,441				4,900		93,101
1,235,586	Lamont (Monitor)							12,348	31,139	26,226	42,819	13,777	2,600					67,652	31,323	227,884
516,159	Lee Peck (D)										2,844									2,844
6,359	Lincoln									1,813	26,019	8,757						43,622	72,959	153,170
152,967	Loretto											8,131	55,983	53,160	34,334	54,104	68,447	61,824	61,219	400,202
16,043	Ludington	166,974	101,165	124,194	74,454	101,653	61,883	116,297	97,355	141,303	15,777	109	354							1,001,518
880,362	Manganite								6,844											6,844
375,451	Mansfield								18,303	49,836	69,259	69,558				37,182	60,739	86,607	90,155	481,639
4,648	Mastodon	22,054	18,187	11,737	41,640	48,794	51,463	63,511	66,526	45,370	9,150	23,485		23,733	60					425,708
150,216	Metropolitan	60,497	27,577		6,393	9,070	3,490													107,027
1,519,723	Michigan Explo. Co.											505	77	1,071		216				1,869
12,708	Millie (Hewitt)	21,368	7,927	4,627	5,547	1,163	11,124	12,274	39,232	5,889	6,780		13,062	10,924	21,815	10,374	17,430	15,194	14,922	219,522
1,123,071	Nanaimo	31,701	37,620		5,460	30,460	5,744		3,441	13,200										127,566
37,587	Northwestern	7,202	10,004																	17,206
5,753	Norway (F)	696,420	71,710	67,741	93,878	95,726	87,260	68,044	61,717	4,089	44,767									1,291,352
23,395	Paint River	12,488	11,652	2,373	13,933	10,240	12,506	32,700	62,654	45,435	18,390								1,316	223,687
59,866	Penn Iron M'g Co.											280,459	175,274	290,622	179,917	237,886	223,713	229,651	197,606	1,815,119
45,993	Perkins	273,229	38,120	18,029	12,852	10,834	16,684	12,354	11,971					2,161						397,225
59,114	Perry	3,138																		3,138
15,409	Pembroke								26,991	64,507	115,27	165,745	304,010	262,551	272,587	279,855	305,072	530,12	374,043	2,701,763
5,508,945	Quinnesec	229,942	16,995	14,110	13,442	6,585	2,249							761				11,050	25,967	321,101
73,844	Riverton																	2,262	71,004	73,266
6,449	Selden				790	1,302														2,092
32,415	Sheridan							1,102	595	7,137	45,745	2,234		16,754	3,419	146		31,104	8,063	116,269
373,173	South Mastodon						2,722	4,905	1,476											8,203
491	Stephenson	34,743			1,018	3,589														39,350
180,860	Stinson River					6,829	7,800	4,775												18,404
1,712,330	Verona																		5,143	5,143
1,910,251	Vulcan (F)	446,523	101,722	124,125	143,939	205,036	129,541	153,900	104,996	78,967	179,004									1,668,554
47,174	Walpole					1,740	900	9,614	2,940	5,895										19,089
8,261	Youngstown	21,450	8,344		25,635	34,418	12,699		44,469	3,705				13		661				151,425
86,068																				
16,169	Total	3,890,389	895,634	690,435	880,006	1193,345	1191,101	1796,754	2282,237	1824,619	2261,499	1466,197	1137,949	1,923,798	1,560,467	1,937,013	2,522,265	3,301,052	3,261,221	34,015,979
451,434	**Vermilion Range.**																			
666,411	Chandler						454,612	306 220	336,002	373,969	651,655	435,930	558,050	605 024	471,545	438,365	715,919	808,359	644,801	6,400,451
17,789	Minnesota		62,124	225,484	304,396	394,252	57,341	535,318	532,009	517,570	499,355	370,303	390,463	432,760	448,707	592,196	426,040	457,732	325,020	6,970,059
287,805	Pioneer							3,144	12,012	3,079	2,651			40,054	149,073	207,103	123,183	339,897	450,794	1,330,960
21,887	Savoy (and Sibley)																	86,191	175,116	261,307
245,412	Zenith										14,991	14,388			18,765	40,817		79,325	60,089	228,373
164,244																				
204,949	Total		62,124	225,484	304,396	394,252	511,953	844,682	880,014	894,618	1167,650	820,621	948,513	1,077,836	1,088,090	1,278,481	1,265,142	1,771,502	1,655,820	15,191,180
32,970	**Gogebic Range.**																			
90,371	Ada																	7,977	25,047	33,024
152,349	Anvil					10,075	24,676	47,000	45,690	73	42,990		13,297	68,064	57,483		5,037			313,485
34,905	Ashland			6,741	74,015	175,563	174,183	257,915	435,949	267,439	231,896	66,067	83,020	126,096	91,149	111,625	123,208	154,615	232,961	2,612,442
133,077	Atlantic					1,369								70,989	60,727	50,307	38,058	19,964	135,955	377,369
50,870	Aurora			5,422	94,533	159,252	179,937	199,865	246,696	83,554	319,482	179,028	203,152	245,883	187,169	166,122	133,076	170,369	193,111	2,766,670
10,555	Bessemer				4,788	16,101														20,889
557,077	Bliss Jacket					1,799														1,799
6,560	Brotherton				8,880	21,721	40,639	53,267	80,486	46,574	130,833	18,905	47,148	40,587	50,490	46,186	73,198	78,858	89,804	827,556
592,783	Cary (and Superior)							56,542	116,203	121,186	106,484	28,578	16,558	52,349	38,821	37,308	43,162	62,524	125,496	805,212
	Chicago														504				633	1,137
	Colby (E)		1,022	81,302	257,432	258,518	285,880	136,833	193,038	9,619	69,968	59,346	32,616		48,492	22,921	152,875	103,239	32,572	1,748,673
	Eureka								23,794	13,907	10,655	31,385	18,329	26,105	4,544					128,719
353,121	Federal								21,150	6,778										27,928
19,368	First National					1,997														1,997
577,255	Germania			5,468	19,734	61,714	53,918	103,169	52,000	22,383	4,283	7,964				1,015			986	332,634
120,530	Hennepin						28,721	76,545	63,903	15,759									7,728	192,656
134,041	Imperial										8,515									8,515
63,071	Iron Belt						30,000	51,551	110,368	1,506	161,635	23,976	45,109	148,228	81,351	96,763	58,418	105,934	54,664	969,503
63,444	Iron Chief				9,950	2,249														12,199
67,068	Iron Chief No. 2				551															551
20,626	Ironton				18,424	24,762		8,635	6,247	300		1,651				1,265			33,893	58,368
43,803	Jack Pot										3,944									40,753
31,818	Kakagon				18,497	52,179	1,228													71,904
28,879	Meteor (Comet)								2,882	10,144	84,779	9,604	11,782							97,387
46,577	Mikado													4,788		11,397		10,524	7,844	27,509
30,537	Minnewawa																	1,255	1,090	1,255
94,229	Montreal				23,013	43,969	38,015	42,724	16,726	70,108	58,725	34,299	46,037	138,882	131,531	191,106	270,776	153,307	107,524	1,366,767
79,181	New Davis								1,497		21,754	15,210		10 253				5,029	3,569	57,312
59,447	Newport				20,184	75,699	69,145	36,987	71,488	105,606	165,962	109,718	150,392	157,821	142,309	150,979	196,953	263,711	217,201	1,934,176
37,134	Nimikon				4,105	23,217	1,313													28,635
33,961	Norrie		15,419	124,844	237,254	412,196	674,394	906,728	758,572	985,216	472 062	621,608		738,480	329,068	604,281	700,990	714,669	666,389	8,962,170
15,998	Odanah				13,714	30,475	5,412	13,354	1,965		6,711	3 95	2,437							77,124
74,585	Pabst		1,103	17,979	19,906	49,576	116,376	172,060	130,226	113,245	104,510	206,074		219,960	68,984	220,496	223,891	203,869	239,242	2,167,897
21,132	Palms				1,414	9,725	35,245	50,604	32,227	102,382	2,658	37,911		46,965	114,108	207,153	175,925	154,705	139,658	1,110,680
14,073	Penoo					26,687	574								13,185	120				40,566
32,686	Pike																		3,434	3,434
73,845	Ruby (Puritan)				16,388	45,000	3,058	9,472	11,694	913										86,525
57,210	Section 33							73,370	126,963	38,576	14,681									253,590
18,426	Shores										2,912				12,196	16,102	15,691	11,819		55,808
21,564	Sparta													1,950						4,862
14,382	Sunday Lake		1,405	10,963	18,137				6,010	64,902	56,046	22,876	34,323	20,970	89,441	45,815		12,526	74,097	457,511
12,165	Superior			2,690	27,763				36,675	10,710	13,192		30,567							121,627
31,675	Tilden									28,415	233,356	135,118	209,077	418,188	250,205	276,890	287,203	500,830	481,909	2,821,191
16,031	Trimble				10,780	12,764	2,387													25,931
18,297	Tyler's Forks								10,683											10,683
14,890	Valley				1,878															1,878
	Windsor							14,576	37,210	97	53,242	2,474		11,438	28,154	385			488	148,064
10,077	Total		1,022	119,860	753,362	1322,878	1437,096	2008,394	2847,810	1839,574	2971,991	1329,385	1809,468	2,547,976	1,799,971	2,258,236	2,498,461	2,795,856	2,875,295	31,216,635
2,230	GRAND TOTAL	22,024,522	2518,693	2466,642	3565,144	4762,107	5063,877	7292,643	9003,725	7071,053	9072,241	6065,716	7748,312	10.429,037	9,934,828	12,464,574	14,024,673	18,251,804	19,059,393	171,418,984

...nthrop. D—Cherry Valley Ore. E—Includes Tilden up to 1891. F—1893 and later under Penn Iron Mining Co. G—Formerly Claire. H—Now Riverton.